SECTION 200. EARTHWORK, LANDSCAPING, EROSION CONTROL

EARTHWORK

SECTION 201. CLEARING, TREE REMOVAL AND PROTECTION, CARE AND REPAIR OF EXISTING PLANT MATERIAL

201.01 Description. This work shall consist of performing the following items wherever they occur within the right of way, or within the limits of construction, including the areas of borrow pits furnished by the Department.

(a) Clearing. Clearing shall consist of the removal and disposal of all obstructions such as fences, walls, foundations, buildings, accumulations of rubbish of whatever nature and existing structures, the removal of which is not otherwise provided for in Article 501.05; all logs, shrubs, bushes, saplings, grass, weeds, other vegetation and stumps of less diameter than 150 mm (6 in.).

(b) Tree Removal. Tree Removal shall consist of the cutting, grubbing, removal and disposal of trees and stumps, as hereinafter defined.

(c) Protection of Existing Plant Material. Protection of existing plant material shall consist of directing work activity away from and protecting trees, shrubs, turf and herbaceous plants on and adjacent to the right of way.

(d) Care of Existing Plant Material. Care of existing plant material shall consist of pruning, fertilizing and watering existing plant material to maintain health and vigor during and following construction activity.

(e) Repair or Replacement of Existing Plant Material. Repair or replacement of existing plant material damaged by the Contractor shall consist of restoring to original condition specific plant material that was designated to be saved within the limits of construction, or restoring plant material damaged outside the limits of construction.

201.02 Definitions. Tree - A woody, perennial plant having a single main stem or trunk, the diameter of which is 150 mm (6 in.) or more at a point 1.3 m (4.5 ft) above the highest ground level at the base of the tree. Those having a diameter less than 150 mm (6 in.) will be considered saplings. A multiple-stem tree that forks below the 1.3 m (4.5 ft) point of measurement will be considered a cluster of individual trees. A tree that forks at or above the 1.3 m (4.5 ft) point of measurement will be considered a single tree.

A tree stump with a diameter at cut off of 150 mm (6 in.) or more will be considered as a tree for purposes of measurement and removal.

Limits of Construction - A boundary line, not necessarily the right-of-way line, extending along each side of the centerline of the improvement as shown on the plans or cross sections, or as designated by the Engineer.

Root Zone - An area around a plant extending at least as far from the base as the longest horizontal branches.

CONSTRUCTION REQUIREMENTS

201.03 Removal of Obstructions and Other Materials. All items defined as clearing in Article 201.01(a) shall be removed and disposed of as required by these Specifications.

201.04 Tree Removal. Prior to beginning tree removal, all requirements of Article 201.05(a), Protection of Existing Plant Material, shall be completed. All trees except those designated to be saved, and all stumps, shall be cut and disposed of according to Article 202.03. Trees and stumps within the slope limits of embankments 600 mm (2 ft) or more in depth shall be cut off at ground level. All other trees and stumps within the right of way shall be removed to a depth of not less than 300 mm (12 in.) below the elevation of the subgrade, the finished earth surface or the ground line. Trees of Osage Orange shall not be cut off as specified above, but shall be pulled or grubbed in such a manner as to insure complete removal.

201.05 Protection of Existing Plant Material. All plant material designated to be saved, or outside of the limits of construction, shall be protected prior to beginning any clearing or removal work and shall remain protected during subsequent construction work.

Parking or maneuvering of machinery, stockpiling of materials or any other use will not be allowed upon unpaved areas within 3 m (10 ft) of the root zone of trees or plants designated to be protected.

If requested by the Contractor, the Engineer will stake or otherwise mark these protection limits.

(a) Temporary Fencing. The Contractor shall manually erect a temporary fence as designated on the plans or where directed by the Engineer. The temporary fence shall be similar to plastic or wood lathe snow fence, and shall be a minimum of 1 m (4 ft) high with stakes placed a maximum of 4.5 m (15 ft) apart.

(b) Tree Trunk Protection. The Contractor shall provide 50 mm by 200 mm by 2.4 m (2 in. by 8 in. by 8 ft) boards banded continuously around each trunk to prevent scarring of trees shown on the plans or designated by the Engineer. For multistem trees, saplings, and shrubs to be protected within the area of construction, temporary fencing may be used for trunk protection.

(c) Pruning for Safety and Equipment Clearance. All pruning shall be done according to the National Arborist Association's Pruning Standards for Shade Trees Class II - Standard pruning specifications. Plant material shall be pruned to provide a minimum vertical clearance of 6 m (20 ft) from the finished surface of the road bed and shoulders. Pruning for sight distance and other safety purposes shall be as shown on the plans or as directed by the Engineer. Branches on existing plant material to remain that need to be removed for safety or equipment clearance shall be pruned prior to or during

the clearing operation. Breaking off branches of plant material to remain during clearing or construction operations will not be allowed.

201.06 Care of Existing Plant Material. If construction is to occur within the root zone of existing plant material, root pruning and special plant care will be required, as hereinafter specified. All pruning shall be performed by a professional arborist (someone whose principal occupation is the care and maintenance of trees).

(a) Root Pruning. Root pruning using an approved mechanical root pruning saw shall be performed prior to digging where noted on the plans, or directed by the Engineer. Whenever roots of plant material to remain are exposed during construction, the damaged root ends are to be removed by cutting them off cleanly.

Pruning shall be done in the presence of the Engineer and in such a manner as to preserve the natural growth habit of each plant.

Any damage to the root zone, as determined by the Engineer, shall be compensated by pruning an equivalent amount of the top vegetative growth of the plant material within one week following root damage.

The procedure of “drop crotch” pruning shall be employed for all trimming of branches in excess of 50 mm (2 in.) in diameter.

(b) Fertilizer Nutrients. Fertilizer nutrients shall be applied within 48 hours after root damage occurs. A fertilizer with a 1:1:1 ratio shall be applied at the rate of 2 kg (5 lb) of nutrients per 90 sq m (1000 sq ft).

Application shall be accomplished by placing dry fertilizer in holes in the soil. The holes shall be 200 to 300 mm (8 to 12 in.) deep and spaced 600 mm (2 ft) apart in an area beginning 750 mm (30 in.) from the base of the plant. Holes can be punched with a punch bar, dug with a spade, drilled with an auger or any other method approved by the Engineer. Approximately 10 g (0.02 lb) of fertilizer nutrients shall be placed in each hole [250 holes/90 sq m (250 holes/1000 sq ft)].

If the Engineer determines that the hole method of fertilizer placement is not practical or desirable, an approved method of uniform surface application will be allowed.

(c) Supplemental Watering. In case of inadequate rainfall, as determined by the Engineer, supplemental water shall be applied within 48 hours of any root damage. The water shall be applied at the rate of 9 L/sq m (2 gal/sq yd) of surface area within the root zone of plant material having sustained damage to the root zone. Subsequent weekly waterings shall be applied if deemed necessary by the Engineer.

(d) Tree Pruning. Tree pruning shall consist of pruning branches, for aesthetic and structural enhancement, of existing trees as shown on the plans or as directed by the Engineer. The National Arborist Association’s Pruning Standards for Shade Trees Class II - Standard Pruning specifications shall be followed. All branch pruning shall be done between October 15 and April 15, when the trees are dormant.

201.07 Repair or Replacement of Existing Plant Material. The Contractor shall repair or replace any and all damage, deemed unnecessary by the Engineer to any existing or newly installed plant material at his/her own expense. Unnecessary damage to ground cover or turf shall be repaired or replaced as specified for restoration of similar areas within the plans, or as directed by the Engineer, and shall be at the Contractor's expense.

All replacement planting under this Article shall be according to Section 253 and Article 1081.01; and shall be barerooted, or balled and burlapped according to the transplanting requirements of the plants.

Replacement, if required, shall be as follows:

(a) Trees. Furnish, deliver, and plant a tree of the same species and variety and of the same size; or furnish, deliver, and plant at locations designated by the Engineer, a number of saplings of the same species and variety, each having a minimum diameter of 50 mm (2 in.), with the sum of the millimeter (inch) - diameters of saplings equaling the millimeter (inch) diameter of the tree to be replaced.

(b) Shrubs, Small Trees or Evergreens. Furnish, deliver, and plant a plant of the same species and variety, and of the same size in height or width as specified in Article 1081.01(b), Types 1, 2, 3 and 4; or, furnish, deliver and plant at locations designated by the Engineer, a number of plants of the same species and variety whose total measurements shall equal the measurement of the plant to be replaced, measured as above.

201.08 Removal of Saplings, Bushes and Roots. Prior to beginning removal of saplings, bushes, and roots, all requirements of Art. 201.05(a) shall be completed. All saplings and bushes, except those designated to be saved, and all roots within the slope limits of embankments 600 mm (2 ft) or more in depth shall be cut off at the ground level. All other saplings, bushes and roots within the right of way shall be removed to a depth of not less than 300 mm (12 in.) below the elevation of the subgrade, the finished earth surface, or the ground line, and at least below the bottom of the subbase material. Bushes of Osage Orange shall not be cut off as specified above, but shall be pulled or grubbed in such a manner as to insure complete removal.

201.09 Disposal of Materials. Materials shall be disposed of according to Article 202.03.

201.10 Method of Measurement.

(a) Clearing. Clearing will not be measured for payment.

(b) Tree Removal.

(1) Unit Diameter. Trees to be removed as a payment item, but not measured in hectares (acres), will be measured per unit of diameter where one unit is equal to 25 mm (1 in.). The diameter will be measured at a point 1.3 m (4.5 ft) above the highest ground level at the base of the tree and will be determined by dividing the measured circumference of the tree by 3.1416. Stumps will be measured at the

elevation of cut off. A multiple stem tree's branches having a diameter of 150 mm (6 in.) or more at a point 1.3 m (4.5 ft) above the highest ground level at the base of the tree will be measured for payment as individual trees. The accumulated total number of units will be the pay quantity.

(2) Hectare (Acre) as Unit.

a. Contract Quantities. The requirements for the use of contract quantities shall be according to Article 202.07.

b. Measured Quantities. Trees to be removed will be measured by the hectare (acre) when included in the contract as a payment item and shown at definite locations on the plans or staked for removal by the Engineer. The entire area shown on the plans, and directed by the Engineer, will be used in computing the hectares (acres). No deductions will be made for bare areas and existing roads occurring within these limits. Any removal of bushes or saplings within such areas will not be measured separately for payment.

(3) When it is necessary to remove trees in connection with borrow pits furnished by the Contractor, trees will not be measured for payment.

(c) Protection of Existing Plant Material.

(1) Temporary Fencing. Temporary fencing will be measured for payment in meters (feet) in place.

(2) Tree Trunk Protection. Tree trunk protection will be measured for payment as each per tree. A tree with from one to three stems with one stem having a diameter of 150 mm (6 in.) or more or a sapling shall be measured as one tree. Tree trunk protection shall include furnishing, installing and removing this item.

(3) Pruning for Safety and Equipment Clearance. Pruning for safety and equipment clearance will not be measured for payment.

(d) Care of Existing Plant Material.

(1) Tree Root Pruning. Tree root pruning will be measured for payment Clearing, Tree Removal and Protection, Care and Repair of Existing Plant Material as each per tree. Roots pruned on trees with one to three stems with one stem having a diameter equal to or greater than 150 mm (6 in.) will be measured as individual items. All pruning, including top pruning necessary to maintain the vigor of the tree, shall be completed prior to measurement for payment.

Trimming of roots exposed during excavation will not be measured for payment.

(2) Fertilizer Nutrients. Fertilizer will be measured by weight in kilograms (pounds) of actual nutrients used

(3) Supplemental Watering. Supplemental watering will be measured for payment in units of 1000 L (1000 gal) of water applied to the root zones of plant material.

(4) Tree Pruning. Tree pruning for trees and saplings 25 to 250 mm (1 to 10 in.) in diameter will be measured for payment as each per tree or sapling. Tree pruning for trees over 250 mm (10 in.) in diameter will be measured for payment as each per tree. Measurement of trunk diameters will be according to Article 201.10(b)(1).

201.11 Basis of Payment

(a) Tree Removal. Tree removal will be paid for at the contract unit prices per unit diameter for TREE REMOVAL (6 to 15 UNITS DIAMETER), TREE REMOVAL (OVER 15 UNITS DIAMETER), TREE REMOVAL, SPECIAL (6 to 15 UNITS DIAMETER) and TREE REMOVAL, SPECIAL (OVER 15 UNITS DIAMETER); and per hectare (acre) for TREE REMOVAL, HECTARES (ACRES).

If the contract includes a payment item for Tree Removal, Hectares (Acres) but does not include a payment item for Tree Removal, Units Diameter, any tree removal not paid for as Tree Removal, Hectares (Acres), will be paid for according to Article 109.04.

(b) Protection of Existing Plant Material. This work will be paid for at the contract unit price per meter (foot) for TEMPORARY FENCE and at the contract unit price each for TREE TRUNK PROTECTION.

If no pay items have been established in the contract for the protection of existing plant material, this work will be paid for according to Article 109.04.

(c) Care of Existing Plant Material. This work will be paid for at the contract unit price each for TREE ROOT PRUNING, TREE PRUNING (25 to 250 MILLIMETERS DIAMETER) (1 to 10 in. DIAMETER) and TREE PRUNING (OVER 250 MILLIMETERS DIAMETER) (OVER 10 in. DIAMETER); at the contract unit price per kilogram (pound) for NITROGEN FERTILIZER NUTRIENTS, POTASSIUM FERTILIZER NUTRIENTS, and PHOSPHORUS FERTILIZER NUTRIENTS; and at the contract unit price per unit for SUPPLEMENTAL WATERING.

Top pruning necessary to maintain the vigor of the tree will not be paid for as a separate item, but shall be included in the bid price for TREE ROOT PRUNING.

If no pay items have been established in the contract for the care of existing plant material, this work will be paid for according to Article 109.04.

SECTION 202. EARTH AND ROCK EXCAVATION

202.01 Description. This work shall consist of the excavation and transportation of suitable excavated material to embankment locations throughout the limits of the contract or the excavation, transportation, and disposal of excavated material. This work does not include excavation for structures or channel excavation.

CONSTRUCTION REQUIREMENTS

202.02 Clearing, Tree Removal, and Protection of Existing Plant Material. Prior to starting excavation operations in any area, all clearing, tree removal and protection of existing plant material in that area shall be performed according to Section 201.

202.03 Removal and Disposal of Surplus, Unstable, and Unsuitable Materials and Organic Waste. Suitable excavated materials shall not be wasted without permission of the Engineer. The Contractor shall dispose of all surplus, unstable and unsuitable materials and organic waste, in such a manner that public or private property will not be damaged or endangered.

Suitable earth, stones and boulders naturally occurring within the right of way may be placed in fills or embankments in layers and compacted according to Section 205. Broken concrete without protruding metal bars, bricks, rock stone, reclaimed asphalt pavement with no expansive aggregate or uncontaminated dirt and sand generated from construction or demolition activities may be used in embankment or in fill. If used in fills or embankments, these materials shall be placed and compacted to the satisfaction of the Engineer; shall be buried under a minimum of 600 mm (2 ft) of earth cover (except when the materials include only uncontaminated dirt); and shall not create an unsightly appearance or detract from the natural topographic features of an area. Broken concrete without protruding metal bars, bricks, rock, or stone may be used as riprap as approved by the Engineer. If the materials are used for fill in locations within the right of way but outside project construction limits, the Contractor must specify to the Engineer, in writing, how the landscape restoration of the fill areas will be accomplished. Placement of fill in such areas shall not commence until the Contractor's landscape restoration plan is approved by the Engineer.

Aside from the materials listed above, all other construction and demolition debris or waste shall be disposed of in a licensed landfill, recycled, reused, or otherwise disposed of as allowed by State or Federal solid waste disposal laws and regulations and solid waste determinations of the IEPA.

A permit shall be obtained from IEPA and made available to the Engineer prior to open burning of organic waste (i.e., plant refuse resulting from pruning or removal of trees or shrubs) or other construction or demolition debris. Organic waste originating within the right-of-way limits may be chipped or shredded and placed as mulch around landscape plantings within the right of way when approved by the Engineer. Chipped or shredded material to be placed as mulch shall not exceed a depth of 150 mm (6 in.).

When the Contractor proposes to dispose of surplus excavated material off the right of way, the Contractor shall obtain and file with the Engineer permission in writing, from the property owner, for the use of the property for this purpose. The approval of the proposed disposal sight shall be according to Article 107.22. Any

such disposal shall not create an unsightly or objectionable appearance or detract from the natural topographic features, nor be placed at an elevation higher than that of the adjacent roadway without permission from the Engineer.

All unstable and unsuitable material, including excavated material from sewer trenches or other underground construction, shall be excavated or removed and replaced with material acceptable to the Engineer. Unstable and unsuitable material shall not be used in embankments. If unsuitable material is present at or below the finished grade, it shall be removed and replaced with subbase granular material Type A or Type B, according to Section 311. Unsuitable material shall be placed as directed by the Engineer within the right of way or disposed of by the Contractor outside of the right of way.

202.04 Classification. Excavation material will be classified by the Engineer. All excavation will be classified as Earth Excavation, except those materials provided for in Rock Excavation, Excavation for Structures, Channel Excavation, and Rock Excavation in Channel.

Rock Excavation shall consist of the excavation from the roadway of boulders 0.5 cu m (1/2 cu yd) in volume or greater and all rock in ledges, bedded deposits and conglomerate deposits exhibiting the physical characteristics and difficulty of rock removal as determined by the Engineer.

Rock shall be excavated to a minimum of 75 mm (3 in.) below the subgrade of the proposed pavement, surface course or base course and backfilled with subbase granular material Type A or Type B to the elevations shown on the plans. The surface of the rock excavation shall be free from projecting points, ribs, crevices or undrained pockets. The method of rock removal shall be the option of the Contractor. However, excessive blasting or overshooting will not be permitted.

202.05 Drainage. The excavation shall be maintained so that positive drainage is provided at all times. Ditches and waterways shall be constructed and maintained to the lines, grades and cross sections shown on the plans. The Contractor shall also excavate a ditch at the toe of slope for fills and at the top of slope for cuts at locations designated by the Engineer at the earliest opportunity during construction to control runoff from the embankment or cut section. Material excavated from ditches at the top of slope of cuts shall be placed in a windrow between the ditch and top of slope.

If during the prosecution of the work, it is necessary to interrupt existing sewer or under drainage to complete contract requirements, temporary drainage facilities shall be provided until the permanent drainage work has been completed. The Contractor shall preserve and protect all existing sewer and drainage facilities within the limits of the contract. The Contractor shall be responsible for all cost associated with the repair of sewer or drainage facilities damaged due to negligence on the Contractor's part.

202.06 Excavation for Base Course Widening and Bituminous Shoulders for Pavement Resurfacing. Excavation for the construction of base course widening and for bituminous shoulders when the existing pavement is not to be widened shall be performed according to the details shown on the plans or as directed by the Engineer. The excavated material shall be used to backfill the

remaining portion of the widening trench to the satisfaction of the Engineer after the widening has been constructed and to grade and reshape the shoulders to the new gradeline shown on the plans after the pavement resurfacing has been completed. Backfill shall be completed within 24 hours. The excavated material shall be deposited on the shoulders in such a manner that it will not interfere with drainage or the construction of the base course widening or shoulders and the pavement resurfacing until it can be bladed into final position.

Any surplus excavation not needed for the shoulder reshaping or any unsuitable material shall be disposed of by the Contractor according to Article 202.03.

If sufficient material is not obtained from the excavation for the widening or bituminous shoulder to complete the shoulder grading, the additional material shall be obtained as follows:

(a) From Within the Right of Way. The additional material shall be obtained from ditches within the right of way as directed by the Engineer. The foreslopes, backslopes and ditches in areas from which the additional material is obtained shall be shaped and finished as directed by the Engineer. The longitudinal haul shall not exceed 5 km (3 mile). If material obtained from the ditches is wet and/or difficult to handle, the Contractor may be required to disc and harrow the shoulder after placement of the material.

(b) From an Outside Source. If additional material is not available within the existing right of way, the Contractor, when authorized by the Engineer, may secure material from a source of his/her own choosing provided the material meets the requirements of Article 204.02.

202.07 Method of Measurement.

(a) Contract Quantities. When the project is constructed essentially to the lines, grades, or dimensions shown on the plans and the Contractor and the Engineer have agreed in writing that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured.

(b) Measured Quantities. Earth and rock excavation will be measured in their original positions, and the volumes in cubic meters (cubic yards) computed by the method of average end areas. The volume of any unstable or unsuitable material removed will be measured for payment in cubic meters (cubic yards).

In rock excavation, the Contractor shall strip ledge rock of overburden so that necessary cross sections for measurement may be taken. Vertical measurements for determining end areas shall extend from the surface of the rock to an elevation not more than 150 mm (6 in.) below the subgrade of the proposed pavement structure, as shown on the plans, or to the bottom of the rock where that point is above the subgrade of the proposed pavement structure. Horizontal measurements for determining end areas shall extend not more than 150 mm (6 in.) beyond the slope lines fixed by the Engineer for the work. Boulders and rocks 0.5 cu m (1/2 cu yd) or more in volume will be measured individually and the volume computed from average dimensions taken in three directions.

Subbase granular material used for replacement will be measured in metric tons (ton) or in cubic meters (cu yd) according to Article 311.08.

Subbase granular material used for replacement of rock excavation more than 150 mm (6 in.) below the subgrade of the proposed pavement structure, will not be measured for payment.

Earth moved more than once due to either stage construction or by written authorization of the Engineer will be measured for payment each time it is moved.

Earthwork required for the construction of base course widening for pavement resurfacing will be measured for payment to the neat lines as shown on the plans and the volume computed in cubic meters (cu yd).

Earthwork required for the construction of bituminous shoulders for pavement resurfacing will be measured for payment in units of 30 m (100 ft) along each edge of the pavement.

Additional material needed to reshape the shoulders that is obtained from within the right of way will be measured for payment as specified above for earth excavation.

202.08 Basis of Payment. Earth and rock excavation will be paid for at the contract unit prices per cubic meter (cubic yard) for EARTH EXCAVATION and ROCK EXCAVATION, respectively, which prices shall include other items of work included under the general heading of Earthwork for which no payment item is included in the contract.

Removal and disposal of unstable and/or unsuitable material will be paid for at the contract unit price per cubic meter (cubic yard) for REMOVAL AND DISPOSAL OF UNSUITABLE MATERIAL.

Subbase granular material will be paid for according to Article 311.09.

When the contract does not contain a pay item for removal and disposal of unstable and/or unsuitable material and this item is required, it will be paid for according to Article 109.04.

When the contract does not contain pay items for Rock Excavation or Subbase Granular Material, and these items are required, they will be paid for according to Article 109.04.

Earthwork required for the construction of base course widening for pavement resurfacing will be paid for at the contract unit price per cubic meter (cubic yard) for EARTH EXCAVATION (WIDENING).

Earthwork required for the construction of bituminous shoulders for pavement resurfacing will be paid for at the contract unit price per unit for EXCAVATING AND GRADING EXISTING SHOULDER.

Additional material required in reshaping the shoulders to the new grade line for pavement resurfacing that is obtained from within the right of way will not be paid for separately, but shall be included in the contract unit price per cubic meter (cubic yard) for EARTH EXCAVATION, which price shall include any shaping of ditches and slopes and use of the materials in reshaping the shoulders to the new grade line, including any disking and harrowing that may be required. Additional material required in reshaping the shoulders to the new grade line for pavement resurfacing that is obtained from an outside source will be paid for according to Article 109.04.

Temporary drainage facilities required during the course of construction will be paid for according to Article 109.04 unless otherwise provided for in the contract.

SECTION 203. CHANNEL EXCAVATION

203.01 Description. Channel excavation shall consist of the removal and satisfactory disposal of all materials encountered in the construction of new stream channels and in widening, deepening or straightening existing stream channels.

CONSTRUCTION REQUIREMENTS

203.02 Classification. Excavation in channel will be classified as Channel Excavation and Rock Excavation in Channel, according to Article 202.04.

203.03 Clearing. Tree Removal and Protection of Existing Plant Material. Prior to starting excavation operations, all clearing, tree removal and protection of existing plant material shall be performed according to Section 201.

203.04 Excavation. The Contractor shall notify the Engineer, at least threedays in advance of starting excavation operations, to permit the completion of accurate measurements for volume determinations. Any material excavated before such measurements have been taken will not be paid for.

Channels shall be excavated according to the lines, grades and cross sections shown on the plans; there shall be no deviation from the dimensions shown without the written consent of the Engineer. Excavated materials shall be disposed of as shown on the plans or as directed by the Engineer.

Where piles are to be driven as a part of the permanent improvement, any channel excavation at the location of such piles shall be completed to the final elevation before the piles are driven.

203.05 Method of Measurement. Channel Excavation and Rock Excavation in Channel will be measured for payment according to Article 202.07. The reference to Earth Excavation and Rock Excavation in Article 202.07 shall be construed to include Channel Excavation and Rock Excavation in Channel, respectively.

203.06 Basis of Payment. Channel excavation will be paid for at the contract unit prices per cubic meter (cubic yard) for CHANNEL EXCAVATION and ROCK EXCAVATION IN CHANNEL.

When the contract does not contain a unit price for Rock Excavation in Channel and such excavation is required, it will be paid for according to Article 109.04.

SECTION 204. BORROW AND FURNISHED EXCAVATION

204.01 Description. Borrow and furnished excavation shall consist of excavating suitable materials obtained from borrow locations furnished by the Contractor and transporting the materials to various locations throughout the limits of the contract.

204.02 Borrow Pits. The Contractor shall furnish and pay for all borrow sites or other sources of borrow and obtain from the property owners the necessary agreements for the removal of the material. Neither borrow nor furnished excavation shall be placed in the embankment until the site location, excavation plan, and material have been approved by the Engineer in writing. The material used shall have a Standard Dry Density of not less than 1450 kg/cu m (90 lb/cu ft) when tested according to AASHTO T 99 (Method C) and shall not possess an organic content greater than ten percent when tested according to AASHTO T 194.

At the Contractor's option, commercial borrow sites may be used. When commercial borrow sites are used, the following conditions will not be required.

Under no condition shall borrow sites detract from the appearance of the natural topographic features nor increase the potential hazard to a vehicle that has inadvertently left the roadway. In selecting sites for borrow acquisition, preference shall be given to knobs, hills and rises to reduce the extent of pit development. No portion of any borrow pit shall be located within 15 m (50 ft) or 3 m (10 ft) plus 1 1/2 times the depth of the excavation, whichever is the greater, from any highway right of way except when borrow is obtained above pavement elevation. In order to ensure an aesthetically acceptable borrow site, the steepest slopes used in excavating borrow shall be 1:4 (V:H).

Borrow pits shall not change the general pattern of existing drainage and shall be well drained unless suitable for development as ponds or lakes. Pertinent drainage information shall be shown on the excavation plan or topographic map submitted by the Contractor.

Where the Contractor proposes a borrow site, any portion of which is located within 45 m (150 ft) of any highway right of way, the Contractor's request for approval shall be accompanied by a topographic map showing the original and the proposed final conditions of the entire borrow site. The topographic map shall be drawn to a minimum horizontal scale of 1:500, and 600 mm (2 ft) contour intervals shall be indicated.

When a borrow pit is to be developed as a pond or lake, the Contractor shall submit to the Engineer a written statement from the owner that such a development is planned. Slopes of 1:4(V:H) shall be provided along the periphery of the shoreline. Slopes of 1:2(V:H) will be permitted below a point where the proposed water depth will be 2.5 m (8 ft) or greater. In cases where a dam is necessary to impound water within a borrow pit to be used as a pond, slopes of 1:3(V:H) will be permitted on the water face of the dam. Seeding will not be required below the proposed water elevation.

Borrow sites shall be seeded according to Section 250. The class of seeding and the application rate of fertilizer nutrients and/or ground limestone will be determined by the Engineer. If the proposed borrow site is to revert to agricultural purposes, the Contractor shall submit to the Engineer a written statement from the owner that seeding will not be required. All work in connection with seeding at borrow sites will not be paid for separately.

After the borrow site excavation is completed, the Contractor shall shape the borrow site to conform to the approved topographic map.

204.03 Materials. Materials shall meet the requirements of the following Articles of Section 1000 – Materials:

	Item	Article/Section
(a)	Materials for Settlement Platforms (Note 1)	
(b)	Steel Based Plate	1006.04
(c)	Steel Pipe	1006.18
(d)	Threaded Malleable Iron Floor Flanges	1006.16

Note 1. All materials furnished to construct settlement platforms will be visually inspected by the Engineer at the job site prior to installation and no other inspection or certification will be required.

CONSTRUCTION REQUIREMENTS

204.04 Clearing, Tree Removal, and Protection of Existing Plant Material. Before any material is excavated from a borrow pit, clearing, tree removal and protection of existing plant material over the area included within the limits of the pit shall be performed according to Section 201.

204.05 Excavation. Excavation throughout the borrow pit area shall be as uniform as possible. Upon completion of the excavation operations, all stumps and roots shall be cut off and disposed of according to Article 202.03, and the pits shall be trimmed and cleaned.

204.06 Settlement Platforms. When called for on the plans or should the Contractor request credit for the placement of any additional embankment due to possible settlement during construction, settlement platforms shall be erected at the locations shown on the plans or as directed by the Engineer and as hereinafter specified. Notification by the Contractor shall be made to the Engineer in writing prior to the start of construction.

The settlement platforms shall be placed on natural soil, where practical, after the roadway area has been cleared, disked and compacted. Compacted granular bedding material up to 150 mm (6 in.) thick may be used to properly seat the platform. Granular material to be used for bedding may consist of any fine aggregate meeting the approval to the Engineer. The subgrade or bedding shall be prepared and leveled in such a manner that the platform makes uniform contact.

A 19 mm (3/4 in.) diameter steel pipe shall be attached to a 3 mm (1/8 in.) thick by 1.2 m (4 ft) square steel plate with a threaded malleable iron floor flange welded to the plate. 1.2 m (4 ft) lengths of 19 mm (3/4 in.) diameter pipe shall be added as the height of the embankment increases. The tip of the grade pipe shall at no time extend more than 1.4 m (4 1/2 ft) or less than 150 mm (6 in.).

The Contractor shall exercise extreme caution when placing material adjacent to the settlement plates and no equipment shall pass within 1.5 m (5 ft) of the settlement plate until the height of fill is 1 m (3 ft) above the plate.

A casing of 64 mm (2 1/2 in.) diameter steel pipe (standard) shall be installed around the vertical pipe.

Settlement platforms shall be maintained by the Contractor in the required positions at all times during the construction of the embankment. All movement or disturbance, other than normal settlement, of the settlement platforms shall be immediately corrected by the Contractor by repairing or replacing them as directed by the Engineer. All extensions to the grade pipes shall be added under the supervision of the Engineer.

Settlement readings will be taken by the Engineer as required prior to and after construction of the embankment. The final readings will be taken after the top grade of the embankment has been constructed and has been approved by the Engineer.

When the settlement platform has served its purpose, the pipe extensions shall be removed to at least 600 mm (2 ft) below subgrade, the pipe capped, and the area backfilled and compacted.

204.07 Method of Measurement. Borrow excavation will be measured in its original position by taking cross sections before the work is started and again after it has been completed. The volume in cubic meters (cu yd) of material moved, will be computed by the method of average end areas. Material excavated in excess of that required for the execution of the contract will not be measured for payment.

Furnished excavation will be measured for payment as follows:

(a) Contract Quantities. The use of contract quantities shall conform to the requirements of Article 202.07(a) and to the following:

(1) If the Contractor so requests, the Engineer will reestablish the existing ground line after the clearing and tree removal over the entire embankment areas have been performed according to Section 201 and the top 150 mm (6 in.) of the existing ground surface has been disked and compacted to the satisfaction of the Engineer. Contract quantities will be recalculated based on the difference between the existing ground line shown on the plans and the new ground line established after the clearing, disking and compacting.

(2) If the settlement platforms are erected, the Engineer will reestablish the Existing ground line after the embankment is complete from elevations taken on the grade pipes of the settlement platforms. In reestablishing the existing ground line, no change in elevation from that shown on the plan cross sections will be assumed to have occurred at the intersection of the embankment side slopes and the existing ground. Contract quantities will be recalculated based on the difference between the existing ground line shown on the plans and the new ground line established from the settlement platforms.

(b) Measured Quantities. Furnished excavation will be measured for payment in place and the volume in cubic meters (cu yd) will be computed by the method of average end areas, and then subtracting the final pay quantity of suitable earth excavation adjusted by a shrinkage factor of 25 percent or as shown on the plans. Furnished excavation placed in excess of that required for the execution of the contract will not be measured for payment. The volume of suitable furnished excavation will be computed on the basis of using the existing ground line as shown on the plans, except as specified in (1) and (2) below:

(1) If the Contractor so requests, the Engineer will reestablish the existing ground line after the clearing and tree removal have been performed according to Section 201 and the top 150 mm (6 in.) of the existing ground surface has been disked and compacted to the satisfaction of the Engineer.

(2) If settlement platforms are erected, the Engineer will reestablish the existing ground line after the embankment is complete as specified in Article 204.07(a)(2).

204.08 Basis of Payment. Borrow and furnished excavation will be paid for at the contract unit prices per cubic meter (cubic yard) for BORROW EXCAVATION and FURNISHED EXCAVATION.

SECTION 205. EMBANKMENT

205.01 Description. This work shall consist of the construction of embankments by depositing, placing, and compacting earth, stone, gravel, or other materials of acceptable quality above the natural ground or other surface.

205.02 Equipment. Equipment shall meet the requirements of the following Article of Section 1100 - Equipment:

Item	Article/Section
(a) Disk Harrow	1101.02

CONSTRUCTION REQUIREMENTS

205.03 Preparation of Existing Ground Surface. Before any embankment is placed, all clearing and tree removal over the entire roadway area shall be performed according to Section 201, and the top 150 mm (6 in.) of the existing ground surface shall be disked and then compacted to the satisfaction of the Engineer. Snow and ice shall be removed from the area to be covered by the embankment. Embankment shall not be placed on frozen earth. When construction is resumed after any winter shutdown period, the top 200 mm (8 in.) of all partially completed embankments shall be reprocessed and compacted to the minimum specified density prior to placing more fill material on the embankment.

When embankments are to be constructed on hillsides or slopes, or if existing embankments are to be widened or included in new embankments, the existing slopes shall be plowed deeply. If additional precautions for binding the fill materials together are justified, steps shall be cut into the existing slopes before the construction of the embankment is started.

When embankments are to be constructed over an existing pavement, the following shall govern:

(a) Flexible Pavement (Aggregate Surface, Bituminous Surface Over Flexible Base). When the surface of the pavement is within 150 mm (6 in.) of the elevation of the subgrade, it shall be plowed, disked, or otherwise broken up to a depth of not less than 150 mm (6 in.).

(b) Full-Depth and Rigid Pavement (Full-Depth Bituminous Concrete and PCC Pavement), and PCC Base Course.

(1) When the distance between the existing pavement and the proposed subgrade is between 75 mm (3 in.) and 1 m (3 ft), the existing pavement shall be broken into pieces not to exceed 0.3 sq m (3 sq ft) in surface area. At the option of the Contractor, the broken roadway may stay in place unless otherwise directed by the Engineer.

(2) When the distance between the existing pavement and the proposed subgrade is less than 75 mm (3 in.), the existing pavement shall be removed.

205.04 Placing Material. Embankment material shall be placed according to the following requirements:

(a) General. Embankments shall be constructed of materials that will compact and develop a stability satisfactory to the Engineer. No sod, frozen material or any material which, by decay or otherwise, might cause settlement, shall

be placed or allowed to remain in embankments within the area of the roadbed. Embankments shall be constructed to the height and width deemed necessary to provide for shrinkage during compaction. Upon completion, the embankments shall conform to the lines, grades and cross sections shown on the plans. When embankments are constructed of materials specified in Article 202.03, such materials shall be well distributed, and sufficient earth, or other fine material shall be incorporated with them when they are deposited to fill the interstices and provide solid embankment. No rock, stones or broken concrete more than 100 mm (4 in.) in largest dimension shall be permitted within a vertical distance of 300 mm (12 in.) from the surface of the finished earth grade, or finished earth shoulders. When the contract includes pavement, surface course or base course, the vertical distance may be 75 mm (3 in.) from the finished surface of the subgrade for such construction.

Pieces of concrete, not exceeding 0.5 sq m (2 sq ft) for any area of surface, and large rocks and boulders may be placed in fills without being broken up, provided they are well embedded, and the interstices filled with smaller pieces or smaller material in a manner to give a density satisfactory to the Engineer. The layers of the smaller pieces or smaller material shall not exceed 300 mm (12 in.) in depth.

So far as practicable, each layer of material shall extend the entire length and width of the embankment. The material shall be leveled by means of bulldozers, blade graders or other equipment approved by the Engineer. Each layer shall be not more than 200 mm (8 in.) thick when in loose condition, uniform in cross section, and thoroughly compacted before the next layer is started.

The use of drag line excavators or similar equipment which excavate and deposit material in large unit masses will not be permitted, unless all materials excavated in this manner are spread as provided herein and compacted according to Article 205.06, or as directed by the Engineer.

(b) Adjacent to Structures. When bridges and culverts are not completed in advance of grading operations, an omission in the embankment of not less than 30 m (100 ft) on each side of each structure shall be made, until such omitted embankment shall be placed later according to the requirements of these Specifications. As an alternate method, an omission in the embankment of sufficient length to permit the completion of the structure and the necessary backfills may be made, provided all backfills and omitted embankments are constructed with granular material furnished and placed at the entire expense of the Contractor. The granular material shall conform to Article 1004.06, and shall be compacted according to Article 205.06.

Embankment behind abutments or around structures shall not be constructed until test specimens show that the concrete has attained a modulus of rupture of 4500 kPa (650 psi), and at least seven days have elapsed after the completion of the abutment or structure affected. In the absence of tests to determine the modulus of rupture, the minimum length of time between the completion of the abutment or structure and the placing of

the embankment shall be at least 14 days exclusive of days in which the temperature falls below 7 ºC (45 ºF).

Embankment, behind abutments held at the top by the superstructure, shall not be placed until the superstructure has been completed and the false work removed. Embankment, behind such abutments and behind the walls of culverts having a clear height of more than 1.5 m (5 ft), shall be carried up simultaneously at both ends of the structure, and at no time shall the embankment at one end be more than 600 mm (2 ft) higher than at the other.

Backfill shall not be placed in water at closed abutments, culverts or retaining walls. The excavated area around these structures shall be pumped dry, and any mud or loose material within the excavated space shall be removed. Sloping sides of the excavated space shall be removed. Sloping sides of the excavated space, that would be liable to cause objectionable wedging action of the backfill against the structure, shall be stepped or serrated to prevent such action. At piers, backfill may be placed in water, provided that both the water level and backfill are kept at approximately the same elevation on opposite sides of the pier. A time interval, approved by the Engineer, shall elapse before placing additional fill on one side of the pier above the water surface.

A cubical deposit of porous coarse aggregate, at least 600 mm (2 ft) in each dimension, shall be placed back of each drain hole in abutment and wing walls and culvert side walls. The bottom of this deposit shall be 50 mm (2 in.) below the drain hole. No additional compensation will be allowed for such work. All form boards or other obstructions shall be removed from the drains before the embankment is constructed.

205.05 Compaction. Each layer of the embankment material shall be disked sufficiently to break down oversized clods, mix the different materials, secure a uniform moisture content, and ensure uniform density and compaction. Disking may be omitted if the fill material consists of sand or gravel.

If the roadway embankment is less than 450 mm (1 1/2 ft), all lifts shall be compacted to not less than 95 percent of the standard laboratory density. If the embankment height is between 450 mm and 900 mm (1 1/2 ft and 3 ft) inclusive, the first lift shall be compacted to not less than 90 percent, and the balance to a minimum of 95 percent of the standard laboratory density. If the embankment exceeds 900 mm (3 ft) in height, the lower 1/3 of the embankment, but not to exceed the lower 600 mm (2 ft), shall be compacted in a manner that will yield a minimum of 90 percent of standard laboratory density to the uppermost lift of that portion of the embankment. The next 300 mm (1 ft) of embankment shall be compacted to not less than 93 percent, and the balance of the embankment compacted to not less than 95 percent of the standard laboratory density.

The top 600 mm (2 ft) of all embankments shall not contain more than 120 percent of the optimum moisture determined according to AASHTO T 99 (Method C). The Contractor will be permitted the use of an approved additive to effect a quicker drying time.

The standard laboratory density shall be the maximum dry density determined according to AASHTO T 99 (Method C). A coarse particle correction according to AASHTO T 224 shall be used.

The dry density of the compacted embankment will be determined by the Engineer at regular intervals according to AASHTO T191, Illinois Modified AASHTO T 310 (Direct Transmission Density/Backscatter Moisture), or by other methods approved by the Engineer.

The embankment shall be sprinkled with water when it is necessary to increase the moisture content of the soil to permit the embankment to be constructed to the densities indicated above.

Compacting equipment and compacting operations shall be coordinated with the rate of placing embankment so that the required density is obtained.

Special care shall be exercised in compacting embankments adjacent to structures and in sharp depressions. Where such areas are inaccessible to the compacting equipment being used, the material shall be placed in 200 mm (8 in.) horizontal layers and uniformly compacted with suitable mechanical equipment. Embankment placed adjacent to a structure shall not contain more than 110 percent of the optimum moisture determined according to AASHTO T 99 (Method C).

205.06 Maintaining and Trimming Embankments. The Contractor shall replace, at his/her own expense, any portions of the embankment which have been damaged or displaced by reason of carelessness or negligence on the Contractor's part. After the embankments have been constructed, their sides shall be trimmed to the proper slopes where required, and shall be maintained by the Contractor to the proper elevation and cross section until acceptance.

205.07 Method of Measurement. Embankment will not be measured for payment. Mechanical compaction will not be measured for payment.

205.08 Basis of Payment. Embankment and any additive or water applied will not be paid for directly but shall be considered as included in the various items of excavation, and their construction shall be included in the unit prices for these items.

SECTION 206. GRANULAR EMBANKMENT, SPECIAL

206.01 Description. This work shall consist of the construction of granular embankment by placing and compacting gravel or crushed stone on an existing pavement or surface course.

206.02 Materials. Materials shall meet the requirements of the following Article of Section 1000 - Materials:

Item	Article/Section
(a) Granular Embankment, Special (Note 1)	1004.04

Note 1. The aggregate shall have a bearing ratio of not less than 80. For crushed gravel, crushed stone, and crushed slag, the bearing ratio requirement shall not apply. The bearing ratio will be determined according to the Standard Methods adopted by the Department.

206.03 Equipment. Equipment shall meet the requirements of the following Articles of Section 1100 - Equipment:

Item	Article/Section
(a) Tamping Roller	1101.01
(b) Pneumatic-tired Roller	1101.01
(c) Three-wheel Roller (Note 1)	1101.01
(d) Tandem Roller (Note 1)	1101.01
(e) Vibratory Machine (Note 2)	

Note 1. The three-wheel or tandem roller shall weigh from 5.5 to 9 metric ton (6 to 10 ton) and shall weigh not less than 35 N/mm (200 lb/in.) nor more than 57 N/mm (325 lb/in.) of width of the roller.

Note 2. The vibratory machine shall meet the approval of the Engineer.

CONSTRUCTION REQUIREMENTS

206.04 Placing and Compacting Aggregate. The Contractor shall, at his/her own expense, submit to the Engineer sample of the aggregate to be used for granular embankment at least 15 days prior to starting construction. The sample so submitted will be tested by the Department for acceptance.

The aggregate shall be placed and compacted according to Article 351.05(a) and (b), except that construction shall be alternated on each lane width so that at no time will there be a difference of more than 100 mm (4 in.) in elevation. Construction operations shall be carried on in such a manner that the elevation of adjacent traffic lanes shall be the same when work is suspended at nights and over weekends or holidays.

206.05 Construction of Earth Berm. Prior to allowing traffic on the newly constructed layer, the adjacent earth berm shall be built flush with the top of the aggregate and the edges of the aggregate base compacted to the required density. The cost of constructing the earth berm in this manner will be considered as included in the contract unit price bid for Earth Excavation, Borrow Excavation, or Furnished Excavation and no additional compensation will be allowed.

206.06 Surface Treatment. Immediately following the final shaping and compacting operation, calcium chloride shall be applied to the surface at the rate of 1 to 2 kg/sq m (2 to 4 lb/sq yd) according to Section 663. After the top layer has been completed, it shall be opened to two-way traffic and shall be maintained by the Contractor for traffic until the entire contract is completed and accepted. In no case shall the maintenance period be less than ten days.

206.07 Method of Measurement. This work will be measured for payment in metric tons (tons) or cubic meters (cubic yards) according to Article 311.08.

Aggregate required for maintenance will be measured for payment in metric tons (tons) or cubic meters (cubic yards) according to Article 311.08.

Calcium chloride will be measured for payment according to Article 663.04.

206.08 Basis of Payment. This work will be paid for at the contract unit price per metric ton (ton), or cubic meter (cubic yard) for GRANULAR EMBANKMENT, SPECIAL.

Aggregate required for maintenance will be paid for at the contact unit price per metric ton (ton) or cubic meter (cu yd) for GRANULAR EMBANKMENT, SPECIAL.

Calcium chloride will be paid for according to Article 663.05.

SECTION 207. POROUS GRANULAR EMBANKMENT

207.01 Description. This work shall consist of furnishing, transporting and placing porous granular material. For the purpose of this specification, the embankment may be above the original ground line, or it may be below the water elevation.

207.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Coarse Aggregate	1004.06
(b) Fine Aggregate	1003.04

CONSTRUCTION REQUIREMENTS

207.03 General. The aggregate shall be placed in 150 mm (6 in.) layers, loose measurement, and compacted in a manner approved by the Engineer, except that if the desired results are being obtained, the compacted thickness of any layer may be increased to a maximum of 200 mm (8 in.).

207.04 Method of Measurement. Porous Granular Embankment will be measured for payment in metric tons (tons) according to Article 311.08(b), or in cubic meters (cubic yards) compacted in place and the volume computed by the method of average end areas.

207.05 Basis of Payment. This work will be paid for at the contract unit price per metric ton (ton) for POROUS GRANULAR EMBANKMENT, or at the contract unit price per cubic meter (cubic yard) for POROUS GRANULAR EMBANKMENT.

SECTION 208. TRENCH BACKFILL

208.01 Description. This work shall consist of furnishing fine aggregate for backfilling material for all trenches made in the subgrade of the proposed improvement, and all trenches outside of the subgrade where the inner edge of the trench is closer than 600 mm (2 ft) to the edge of the proposed pavement, stabilized shoulder, curb, or sidewalk.

This work also includes the disposal of the surplus excavated material which is replaced by trench backfill. Such disposal shall be made according to Article 202.03.

208.02 Materials. Materials shall meet the requirements of the following Article of Section 1000 - Materials:

Item	Article/Section
(a) Fine Aggregate	1003.04

208.03 Method of Measurement.

(a) Contract Quantities. The requirements for the use of Contract Quantities shall conform to Article 202.07(a).

(b) Measured Quantities. Trench backfill shall be furnished for backfilling to the full width of the trench. It will be measured in cubic meters (cubic yards) in place, except that the quantity for which payment will be made shall not exceed the volume of the trench as computed by using the maximum width of trench permitted by the Specifications and the actual depth of the completed trench backfill above the center of the pipe, with a deduction for the volume of one-half of the pipe. Any trench backfill required in excess of the maximum quantity specified shall be furnished by the Contractor at his/her own expense.

Any material meeting the requirements of Article 1003.04 which has been excavated from the trenches shall be used for backfilling the trenches. However, no compensation will be allowed as trench backfill for the portion of the trench backfilled with excavated material.

208.04 Basis of Payment. This work will be paid for at the contract unit price per cubic meter (cubic yard) for TRENCH BACKFILL.

SECTION 209. POROUS GRANULAR BACKFILL

209.01 Description. This work shall consist of furnishing and placing porous granular material for backfilling tile or pipe in trenches.

209.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Coarse Aggregate	1004.06
b) Fine Aggregate	1003.04

CONSTRUCTION REQUIREMENTS

209.03 General. The porous granular material shall be placed around the tile or pipe for the full width of the trench. This material shall be carried to the top of all water bearing strata intercepted by the trench or to a minimum of 300 mm (1 ft) above the tile or pipe, as directed by the Engineer. The material shall be placed in layers not exceeding 150 mm (6 in.) in thickness and compacted in a manner approved by the Engineer. The balance of the trench shall be backfilled with approved natural soil.

Surplus excavated material shall be disposed of by the Contractor according to Article 202.03.

209.04 Method of Measurement. Porous granular backfill will be measured in cubic meters (cubic yards) in place, except that the quantity for which payment will be made shall not exceed the volume of the trench as computed by using the maximum width of trench permitted by the Specifications and the actual depth of the completed porous granular backfill above the invert of the pipe, with a deduction for the volume of the pipe. Any porous granular backfill used for the purpose of filling the trench in excess of the maximum quantity specified shall be furnished and placed by the Contractor at his/her own expense.

209.05 Basis of Payment. This work will be paid for at the contract unit price per cubic meter (cubic yard) for POROUS GRANULAR BACKFILL.

SECTION 210. FABRIC FOR GROUND STABILIZATION

210.01 Description. This work shall consist of furnishing and installing geotechnical fabric in subgrades or as embankment foundations.

210.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Geotextile Fabric	1080.02
(b) Coarse Aggregate (Note 1)	1004.04

Note 1. The course aggregate shall be that specified for Granular Embankment Special.

CONSTRUCTION REQUIREMENTS

210.03 Installation Requirements. Fabric shall be delivered to the job site in such a manner as to facilitate handling and incorporation into the work without damage. Material shall be stored in such a manner as to prevent exposure to direct sunlight and damage by other construction activities.

Prior to the installation of the fabric, the application surface shall be cleared of debris, sharp objects and trees. Tree stumps shall be cut to the level of the ground surface. If the stumps cannot be cut to the ground level, they shall be completely removed. In the case of subgrades, all wheel tracks or ruts in excess of 75 mm (3 in.) in depth shall be graded smooth or otherwise filled with soil to provide a reasonably smooth surface.

Fabric may be installed on the application surface either by hand or by mechanical methods, provided that the fabric is not torn or the surface rutted.

Fabric of insufficient width or length to fully cover the specified area shall be lapped, or sewn. The minimum laps for lap only areas are 600 mm (2 ft) and for sewn areas are 100 mm (4 in.). If sewn, the seam strength shall be equal to or exceed the minimum grab tensile strength of the fabric when tested wet.

210.04 Placement of Granular Blanket. The granular blanket shall be constructed to the width and depth required on the plans. Granular Embankment Special shall be used in conjunction with the Geotechnical Fabric. The material shall be back dumped on the fabric in a sequence of operations beginning at the outer edges of the treatment area with subsequent placement towards the middle.

Placement of material on the fabric shall be accomplished by spreading dumped material off of previously placed material with a bulldozer blade or endloader, in such a manner as to prevent tearing or shoving of the cloth. Dumping of material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment shall be allowed on the fabric prior to placement of the granular blanket.

The granular material shall be placed to the full required thickness and compacted to the satisfaction of the Engineer before any loaded trucks are allowed on the blanket.

Fabric which is damaged during installation or subsequent placement of granular material, due to failure of the Contractor to comply with these provisions, shall be repaired or replaced at the Contractor's expense, including costs of removal and replacement of the granular material.

Torn fabric may be patched in place by cutting and placing a piece of the same fabric over the tear. The dimensions of the patch shall be at least 600 mm (2 ft) larger than the tear in each direction, and shall be weighted or otherwise secured to prevent the granular material from causing lap separation.

210.05 Method of Measurement. Geotechnical Fabric will be measured for payment in place and the area computed in square meters (square yards). Granular blanket will be measured for payment in metric tons (tons) or in cubic meters (cubic yards) according to Article 311.08.

210.06 Basis of Payment. Geotechnical Fabric will be paid for at the contract unit price per square meter (square yard) for GEOTECHNICAL FABRIC FOR GROUND STABILIZATION.

The granular blanket will be paid for at the contract unit price per metric ton (ton) for GRANULAR EMBANKMENT, SPECIAL, or at the contract unit price per cubic meter (cubic yard) for GRANULAR EMBANKMENT, SPECIAL.

SECTION 211. TOPSOIL AND COMPOST

211.01 Description. This work shall consist of furnishing, excavating and placing topsoil, special types of topsoil or compost/topsoil blend.

211.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Topsoil (Furnished from outside of the R.O.W.)	1081.05(a)
(b) Compost	1081.05(b)

CONSTRUCTION REQUIREMENTS

211.03 Furnishing and Excavating Topsoil. Topsoil shall be obtained from within the limits of the right of way at the locations and to the depths designated on the plans or approved by the Engineer. This topsoil shall be stockpiled at locations approved by the Engineer. When special types of topsoil are specified, each type shall be handled separately and not allowed to mix with any other material. When special types of topsoil (Hydric, Prairie or Woodland) are specified, the seeds and plants within the excavated special topsoils are desirable to maintain. To keep these seeds and plants viable, the topsoil shall be excavated then placed as directed by the Engineer or as specified in the contract. If stockpiling cannot be avoided, special measures, such as watering the stockpile and planting a cover crop on the stockpile will be required as directed by the Engineer.

If additional topsoil is required to complete the contract to the lines, grades and the minimum thickness shown on the plans, the Contractor shall furnish any additional topsoil from areas outside the limits of the right of way. This additional topsoil obtained from outside the right of way shall be approved by the Engineer prior to its use.

In lieu of furnishing additional topsoil from areas outside the limits of the right of way, the Contractor may request permission to obtain the additional topsoil from areas within the limits of the right of way other than those shown on the plans.

At the Contractor's option or when specified, a blend of topsoil and compost with a maximum of 40 percent compost by volume shall be substituted for the topsoil.

211.04 Placing Topsoil and Compost. Topsoil or compost/topsoil blend shall not be placed until the area to be covered has been shaped, trimmed and finished according to Section 212. All irregularities or depressions in the surface due to weathering or other causes shall be filled or smoothed out before the topsoil is placed. If the existing surface has become hardened or crusted, it shall be disked or raked or otherwise broken up so as to provide a bond with the layer of topsoil to be applied.

The Engineer will verify that the proper topsoil or compost/topsoil blend depth has been applied. After verification of proper depth, the Contractor shall completely incorporate the placed material into the existing surface to a minimum depth of 150 mm (6 in.) below finished grade by disking or tilling.

211.05 Finishing. The surface of the topsoil or compost/topsoil blend shall be free from clods, stones, sticks and debris and shall conform to the lines, grades and the minimum thickness shown on the plans. If required by the Engineer, one rolling of the entire surface shall be made.

211.06 Clearing Area and Disposal of Surplus Material. Upon completion of the work, all areas shall be cleared of equipment, debris, and excess material. Surplus or waste material resulting from construction operations shall be disposed of by the Contractor according to Article 202.03.

211.07 Method of Measurement.

(a) Contract Quantities. The requirements for the use of contract quantities shall conform to Article 202.07(a).

(b) Measured Quantities. Material excavated in excess of that required for the contract will not be measured for payment.

Topsoil Excavation and Placement shall be that material obtained from within the limits of the right of way and will be measured in cubic meters (cubic yards) in its original position. The volume will be computed by the method of average end areas. In no case will the width or depth used for the computations be greater than the dimensions shown on the plans unless such changes have been approved in writing by the Engineer. Topsoil excavation shall include the excavating, hauling and stockpiling of the material in the locations approved by the Engineer. If the Contractor requests and the Engineer approves additional areas within the limits of the right of way for topsoil excavation other than shown on the plans, these added quantities will be deducted from the item of Borrow Excavation, Furnished Excavation or Earth Excavation.

Topsoil Furnish and Place and Compost Furnish and Place shall be that material obtained from outside the right of way and will be measured in square meters (square yards).

Compost used at the Contractor's option will not be measured for payment, but will be considered part of the specified quantities of topsoil.

Excavation and Embankment quantities for the roadway have been computed on the basis of cut and fill to the subgrade of the topsoil.

211.08 Basis of Payment. Topsoil Excavation will be paid for at the contract unit price per cubic meter (cubic yard) for TOPSOIL EXCAVATION AND PLACEMENT.

Topsoil Furnished and Compost Furnished will be paid for at the contract unit price per square meter (square yard) for TOPSOIL FURNISH AND PLACE or COMPOST FURNISH AND PLACE, of the thickness specified.

SECTION 212. FINAL SHAPING,TRIMMING AND FINISHING

212.01 Description. This work shall consist of the final shaping, trimming, and finishing of the roadway, the final finishing and cleaning up of the right of way, and completing the work for acceptance. This work is in addition to the requirements of Article 104.06.

CONSTRUCTION REQUIREMENTS

212.02 Grading Sections. When the contract does not include a surface or base course, the ditches shall be cleaned, all irregularities in the roadbed shall be smoothed out, depressions shall be filled, and the entire roadway shall be shaped, trimmed and finished uniformly to the lines, grades and cross sections shown on the plans, and the right of way cleaned up for final acceptance. The finished surface of the roadbed shall not vary from the lines, grades, and cross sections shown on the plans by more than 50 mm (2 in.).

212.03 Full Depth and Rigid Type Surface Sections. The roadway for concrete pavement, full-depth bituminous concrete, or pavement with concrete base course and any bituminous surface course shall be shaped, trimmed and finished as follows:

(a) Sections Not Previously Graded. The ditches shall be cleaned, and the entire roadway shall be shaped, trimmed and finished uniformly to the lines, grades, and cross sections shown on the plans, and the right of way cleaned up for final acceptance.

(b) Sections Previously Graded. Where it is not necessary to secure material from the backslopes of cuts and ditches to complete the earthwork in the roadbed; or where no work is indicated on the plans which will interfere with such slopes; or where the Contractor's operations do not disturb such slopes, no further work on the slopes will be required. If such slopes are disturbed by the Contractor's operations, the Contractor shall trim and reshape them in a manner satisfactory to the Engineer.

In reshaping existing shoulders and medians, widening existing embankments, or raising existing low shoulders and medians, the Contractor shall construct or reshape the shoulders and medians according to Section 480.

Side slopes of fills shall be trimmed and shaped for a distance of 1.2 m (4 ft), measured from the edge of the shoulder toward the toe of the fill slope. The ditches shall be cleaned, and the right of way cleaned up for final acceptance.

212.04 Nonrigid Type Surface and Base Course Sections. The roadway for nonrigid type surfacings, such as aggregate surface course or any bituminous surface course not built on a Portland Cement Concrete base course, shall be shaped, trimmed and finished as follows:

(a) General. After the surface or base course material has been placed, all additional construction operations shall be performed in such a manner that earth or other objectionable substances will not be deposited on the surface or base course material.

(b) Sections Not Previously Graded. Where the trench method of constructing the surface or base course is required, all final shaping, trimming and finishing of ditches, backslopes of cuts and sideslopes of fills shall be completed to the lines, grades and cross sections shown on the plans, and all shoulder material shall be roughed in before the surface or base course material is placed.

Where the trench method of constructing the surface course is not required, all final shaping, trimming, and finishing of the roadbed shall be completed to the lines, grades and cross sections shown on the plans, before the surfacing material is placed.

(c) Sections Previously Graded. The backslopes of cuts and ditches and the sideslopes of fills shall be finished according to Article 212.03(b) before the surface or base course material is placed.

Where the trench method of constructing the surface or base course is required, all shoulder material shall be roughed in before the surface or base course material is placed.

Where the trench method of constructing the surface course is not required, all final shaping, trimming and finishing of the roadbed shall be completed before the surfacing material is placed.

212.05 Finishing. All unsuitable material, debris, and rubbish, resulting from construction operations, or occurring within the right of way, and all stones or boulders more than 75 mm (3 in.) in largest dimension, shall be removed from the right of way and disposed of by the Contractor according to Article 202.03. The degree of finish for graded slopes outside of the roadbed shall be that which can be obtained by use of suitable mechanical equipment, with only such hand labor as special conditions may require.

Where the roadway has been resurfaced and as directed by the Engineer, any high areas in the existing earth shoulders that remain after resurfacing is complete which would entrap water adjacent to the pavement edge shall be bladed off. The existing earth shoulders shall be sloped to drain, but grading which requires additional material to conform to a uniform cross section will not be required. Immediately prior to final inspection, mowing of the right of way will be required at locations as directed by the Engineer.

212.06 Basis of Payment. Except for blading off high spots in the existing earth shoulders where the roadway has been resurfaced and for mowing immediately prior to final inspection, this work will not be measured or paid for separately, but shall be considered as included in the contract unit price for the particular type of surface course, base course or widening included in the contract. If surface course, base course or widening items are not included in the contract, the cost of final shaping, trimming and finishing shall be considered as included in the contract unit prices for the various items of earthwork.

Blading off high spots in the existing earth shoulders where the roadway has been resurfaced and mowing required immediately prior to final inspection will be paid for according to Article 109.04.

SECTION 213. EXPLORATION TRENCH

213.01 Description. This item shall consist of constructing a trench for the purpose of locating existing farm underdrains within the construction limits of the proposed improvement.

CONSTRUCTION REQUIREMENTS

213.02 General. The exploration trench shall be constructed at the locations shown on the plans or as directed by the Engineer.

The trench shall be not less than 1.3 m (52 in.) in depth, measured from the existing ground elevation. The width of the trench shall be sufficient to allow proper investigation of the entire trench.

When an existing farm underdrain is encountered, another trench shall be excavated on the opposite side of the proposed improvement to establish the line and grade of the existing farm underdrain. Broken tile shall be repaired immediately and no surface runoff shall be allowed to enter any tile.

After the trench has been inspected by the Engineer, the excavated material shall be used to backfill the trench in a manner satisfactory to the Engineer. Any excess material shall be disposed of according to Article 202.03, and the area shall be shaped and trimmed according to Section 212.

When approved by the Engineer, the Contractor may use other means of locating existing farm underdrains.

213.03 Method of Measurement. The exploration trench will be measured for payment in meters (feet) of actual trench constructed.

213.04 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for EXPLORATION TRENCH, of the depth specified.

Other means of locating existing farm underdrains approved by the Engineer, will be paid for according to Article 109.04.

SECTION 214. GRADING AND SHAPING DITCHES

214.01 Description. This work shall consist of grading and shaping existing ditches according to the details shown on the plans or as directed by the engineer.

CONSTRUCTION REQUIREMENTS

214.02 General. All surplus, unstable and unsuitable material shall be disposed of according to Article 202.03.

214.03 Method of Measurement. This work will be measured for payment in meters (feet) along the centerline of the ditch.

The volume of any unstable and/or unsuitable material removed will be measured for payment according to Article 202.07.

214.04 Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for GRADING AND SHAPING DITCHES.

Removal and disposal of unstable and/or unsuitable material will be paid for according to Article 202.08.

LANDSCAPING

SECTION 250. SEEDING

250.01 Description. This work shall consist of preparing the seed bed and placing the seed and other materials required in seeding operations on the shoulders, slopes, and other areas.

250.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Seeds	1081.04
(b) Agricultural Ground Limestone	1081.07
(c) Fertilizer	1081.08

250.03 Equipment. Equipment shall meet the requirements of the following Articles of Section 1100 - Equipment:

Item	Article/Section
(a) Disk	1101.08(a)
(b) Slope Harrow	1101.08(b)
(c) Hydraulic Seeder	1101.08(c)
(d) Cultipacker	1101.08(d)
(e) Spinning Disk Seeders	1101.08(e)
(f) Tractor Drawn or Mounted Seeders	1101.08(f)
(g) Rangeland Type Grass Drill and Interseeding Attachment	1101.08(g)
(h) Slit Seeder	1101.08(h)

CONSTRUCTION REQUIREMENTS

250.04 Fertilizer and Agricultural Ground Limestone Application. When specified for bare earth areas, fertilizer nutrients and agricultural ground limestone shall be uniformly spread over the designated areas immediately prior to seed bed preparation.

When specified for existing turf areas, fertilizer nutrients and agricultural ground limestone shall be uniformly spread over the designated areas during the spring, late summer or early fall seasons. The Contractor shall restore, at his/her expense, any existing turf areas damaged by improper application of fertilizer nutrients or agricultural ground limestone.

When fertilizer is specified, 300 kg (270 lb) of fertilizer nutrients per hectare (acre) shall be applied at 1:1:1 ratio as follows:

Nitrogen Fertilizer Nutrients	100 kg/ha (90 lb/acre)
Phosphorus Fertilizer Nutrients	100 kg/ha (90 lb/acre)
Potassium Fertilizer Nutrients	100 kg/ha (90 lb/acre)

When agricultural ground limestone is specified, it shall be applied at a rate of 4.5 metric tons/ha (2 tons /acre) multiplied by the source correction factor.

250.05 Seed Bed Preparation. For bare earth seeding, seed bed preparation shall not be started until all stones, boulders, debris and similar material larger than 75 mm (3 in.) in diameter have been removed and all other requirements of Section 212 have been completed. The area to be seeded shall be worked to a minimum depth of 75 mm (3 in.) with a disk tiller or other equipment approved by the Engineer, reducing all soil particles to a size not larger than 50 mm (2 in.) in the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting and caking. No seeds shall be sown until the seed bed has been approved by the Engineer.

Seed bed preparation will not be required for Class 7 Seeding if the soil is in a loose condition. Light disking shall be done if the soil is hard or caked.

250.06 Seeding Methods. No seed shall be sown during high winds or when the ground is not in a proper condition for seeding, nor shall any seed be sown until the purity test has been completed for the seeds to be used, and shows that the seed meets the noxious weed seed requirements. The seeding dates for mixture Classes 4 and 5 shall be from May 15 to June 30 and from October 15 to December 1. All equipment shall be approved by the Engineer prior to being used. Prior to starting work, seeders and interseeders shall be calibrated and adjusted to sow seeds at the required seeding rate. Equipment shall be operated in a manner to ensure complete coverage of the entire area to be seeded or interseeded. The Engineer shall be notified 48 hours prior to beginning the seeding operations so that the Engineer may determine by trial runs that a calibration of the seeder will provide uniform distribution at the specified rate per hectare (acre). When seed or fertilizer is applied with a hydraulic seeder, the rate of application shall be not less than 9500 L (1000 gal) of slurry per hectare (acre). This slurry shall contain the proper quantity of seed or fertilizer nutrients specified per hectare (acre). When using a hydraulic seeder, the fertilizer nutrients and seed shall be applied in two separate operations.

All legumes (clover, vetch, birdsfoot trefoil, lespedeza and alfalfa) shall be inoculated with the proper bacteria in the amounts and manner recommended by the manufacturer of the inoculant before sowing or being mixed with other seeds for sowing. The inoculant shall be furnished by the Contractor and shall be approved by the Engineer. The seed shall be sown as soon as possible after inoculation. Seed that has been standing more than 24 hours after inoculation shall be reinoculated before sowing. If legumes are applied by a hydraulic seeder, three times the normal amount of inoculant shall be used.

(a) Bare Earth Seeding. Bare earth seeding shall be done using the following methods unless otherwise specified or directed by the Engineer:

(1) Seeding Classes 1, 2, and 6 shall be sown with a machine that mechanically places the seed in direct contact with the soil, packs and covers the seed in one continuous operation.

(2) Seeding Class 4 shall be sown with a rangeland type grass drill.

(3) Seeding Class 3 may be sown with a hydraulic seeder.

(4) Seeding Classes 5 and 7 shall be sown with a hydraulic seeder or rangeland type grass drill.

Broadcasting or hydraulic seeding will be allowed as approved by the Engineer on steep slopes (over 1:3 (V:H)) or in inaccessible areas where use of the equipment specified is physically impossible. When Seeding Class 7 is used as an erosion control measure to establish temporary cover, hand broadcasting of the seed or other methods approved by the Engineer will be allowed.

(b) Interseeding. Interseeding is the seeding of areas of existing turf. Prior to interseeding, all areas of existing turf to be interseeded except as listed below shall be mowed one or more times to a height of not more than 75 mm (3 in.). The equipment used shall be capable of completely severing all growth at the cutting height and distributing it evenly over the mowed area.

The cut material shall not be windrowed or left in a lumpy or bunched condition. Additional mowing may be required, as directed by the Engineer, on certain areas in order to disperse the mowed material and allow penetration of the seed. The Contractor will not be required to mow within 300 mm (1 ft) of the right-of-way fence, continuously wet ditches and drainage ways, slopes 1:3 (V:H) and greater, or areas which may be designated as not mowable by the Engineer.

Debris encountered during the mowing and interseeding operations which hamper the operation or are visible from the roadway shall be removed and disposed of according to Article 250.05. Damage to the right of way and turf, such as ruts or wheel tracks more than 50 mm (2 in.) in depth, shall be repaired to the satisfaction of the Engineer prior to the time of interseeding.

All seeding classes shall be interseeded using a rangeland type grass drill with an interseeding attachment, except:

(1) When specified in the plans or directed by the Engineer, a slit seeder shall be used to interseed Class 1 or Class 2 seed.

(2) Broadcasting or hydraulic seeding will be allowed as approved by the Engineer on steep slopes (1:3 (V:H) or steeper) or in inaccessible areas where use of the equipment specified is physically impossible. Sufficient water shall be applied to these areas to wash the seed down to the soil.

250.07 Seeding Mixtures. The classes of seeding mixtures and combinations of mixtures will be designated in the plans.

When an area is to be seeded with two or more seeding classes, those mixtures shall be applied separately on the designated area within a seven day period. All seeding shall occur prior to placement of mulch cover. A Class 7 mixture can be applied at any time prior to applying any seeding class or added to them and applied at the same time.

Table 1 - SEEDING MIXTURES			
CLASS – TYPE		SEEDS	KG/HECTARE(LB/ACRE)
1	Lawn Mixture 7/	Ky Bluegrass	110 (100)
		Perennial Ryegrass	70 (60)
		Creeping Red Fescue	50 (40)
1A	Salt Tolerant	Bluegrass	70 (60)
	Lawn Mixture 7/	Perennial Ryegrass	20 (20)
		Dawsons Red Fescue	20 (20)
		Scaldis Hard Fescue	20 (20)
		Fults Salt Grass*	70 (60)
1B	Low Maintenance	Fine Leaf Turf-Type Fescue 3/	170 (150)
	Lawn Mixture 7/	Perennial Ryegrass	25 (20)
		Red Top	10 (10)
		Creeping Red Fescue	25 (20)
2	Roadside Mixture 7/	Alta Fescu or Ky 31	110 (100)
		Perennial Ryegrass	55 (50)
		Creeping Red Fescue	50 (40)
		Red Top	10 (10)
2A	Salt Tolerant	Alta Fescue or Ky 31	70(60)
	Roadside Mixture 7/	Perennial Ryegrass	20 (20)
		Dawsons Red Fescue	20 (30)
		Scaldis Hard Fescue	20 (30)
		Fults Salt Grass 1/	70 (60)
3	Slope Mixture 7/	Alta Fescue or Ky 31	45 (40)
		Perennial Ryegrass	25 (20)
		Alsike Clover 2/	5 (5)
		Birdsfoot Trefoil 2/	10 (10)
		Andropogon Scoparius (Little Bluestem)	5 (5)
		Bouteloua Curtipendula (Side-Oats Grama)	10 (10)
		Fult Salt Grass 1/	35 (30)
		Oats, Spring	55 (50)
4	Native Grass 4, 6/	Andropogon gernadi (Big Blue Stem)	4 (4)
		Andropogon scoparius (Little Blue Stem)	5 (5)
		Boutelova curtipendula (Side-Oats Grama)	5 (5)
		Elymus canadensis (Wild Rye)	1 (1)
		Panicum virgatum (Switch Grass)	1 (1)
		Sorghastrum nutons (Indian Grass)	2 (2)
		Annual Ryegrass	30 (25)
		Oats, Spring	30 (25)
		Perennial Ryegrass	15 (15)

CLASS – TYPE		SEEDS	KG/HECTARE(LB/ACRE)
4A	Low Profile Native Grass 6,8/	Andropogon scoparius (Little Blue Stem)	5 (5)
		Boutelova curtipendula (Side-Oats Grama)	5 (5)
		Elymus canadensis (Wild Rye)	1 (1)
		Sporobolus heterolepsis (Prairie Dropseed)	0.5 (0.5)
		Annual Ryegrass	30 (25)
		Oats, Spring	30 (25)
		Perennial Ryegrass	15 (15)
4B	Wetland Grass and Sedge Mixture 6,8/	Annual Ryegrass	30 (25)
		Oats, Spring	30 (25)
		Wetland Grasses (Below)	6 (6)
	Species	% By Weight 5/	
	Calamagrostis canadensis (Blue Joint Grass)	12	
	Carex lacustris (Lake-Bank Sedge)	6	
	Carex slipata (Awl-Fruited Sedge)	6	
	Carex stricta (Tussock Sedge)	6	
	Carex vulpinoidea (Fox Sedge)	6	
	Eleocharis aciculoris (Needle Spike Rush)	3	
	Eleocharis obtusa (Blunt Spike Rush)	3	
	Glyceria striata (Fowl Manna Grass)	14	
	Juncus effusus (Common Rush)	6	
	Juncus tenuis (Slender Rush)	6	
	Juncus torreyi (Torrey's Rush)	6	
	Leersia oryzoides (Rice Cut Grass)	10	
	Scirpus acutus (Hard-Stemmed Bulrush)	3	
	Scirpus atrovirens (Dark Green Rush)	3	
	Scirpus fluviatilis (River Bulrush)	3	
	Scirpus validus (Softstem Bulrush)	3	
	Spartina pectinata (Cord grass)	4	

CLASS - TYPE	SEEDS	KG/HECTARE(LB/ACRE)
5 Forb With Annuals Mixture	Annuals Mixture (Below) 6,8/	1 (1)
	Forb Mixture (Below) 6,8/	10 (10)

Annuals Mixture - Mixture not exceeding 25% by weight of any one species, of the following:

Coreopsis lanceolata (Sand Coreopsis)
Chrysanthemum maximum (Shasta Daisy)
Gaillardia pulchelle (Blanket Flower)
Ratibida columnitera (Long-Headed Coneflower)
Rudbeckia hirta (Black-Eyed Susan)

Forb Mixture-Mixture, not exceeding 5% by weight PLS of any one species, of the following:

Amorpha canescens 2/ (Lead Plant)
Anemone cylindrica (Thimble Weed)
Asclepias tuberosa (Butterfly-Weed)
Aster azureus (Sky Blue Aster)
Aster laevis (Smooth Aster)
Aster novae-angliae (New England Aster)
Baptisia leucantha 2/ (White Wild Indigo)
Ceanothus americanus (New Jersey Tea)
Coreopsis palmata (Prairie Coreopsis)
Echinacea pallida (Pale Purple Coneflower)
Eryngium yuccifolium (Rattlesnake Master)
Helianthus mollis (Downy Sunflower)
Heliopsis helianthoides (Ox-Eye)
Heuchera richardsonii (Alum Root)
Liatris aspera (Rough Blazing Star)
Liatris pyscostachya (Prairie Blazing Star)
Monarda fistulosa (Prairie Bergamont)
Parthenium integrifolium (WildQuinine)
Pedicularis canadensis (Louse Wart)
Petalostemum candidum 2/ (White Prairie Clover)
Petalostemum purpureum 2/ (Purple Prairie Clover)
Physostegia virginiana (False Dragonhead)
Potentilla arguta (Prairie Cinquefoil)
Ratibida pinnata (Yellow Coneflower)
Rudbeckia subtomentosa (Fragrant Coneflower)
Silphium laciniatum (Compass Plant)
Silphium terebinthinaceum (Prairie Dock)
Solidago rigida (Rigid Goldenrod)
Tradescantia ohiensis (Spiderwort)
Veronicastrum virginicum (Culver's Root)

CLASS – TYPE	SEEDS	KG/HECTARE(LB/ACRE)
5A Large Flower Native Forb Mixture 6,8/	Forb Mixture (Below)	5 (5)

Species	% By Weight 5/
Aster novae-angliae (New England Aster)	5
Echinacea pallida (Pale Purple Coneflower)	10
Helianthus mollis (Downy Sunflower)	10
Heliopsis helianthoides (Ox-Eye)	10
Liatris pyscostachya (Prairie Blazing Star)	10
Ratibida pinnata (Yellow Coneflower)	5
Rudbeckia hirta (Black-Eyed Susan)	10
Silphium laciniatum (compass Plant)	10
Silphium terebinthinaceum (Prairie Dock)	20
Solidago rigida (Rigid Goldenrod)	10

CLASS – TYPE	SEEDS	KG/HECTARE(LB/ACRE)
5B Wetland Forb	Forb Mixture (Below) 6,8/	2 (2)
Species	% By Weight 5/	
Acorus calamus (Sweet Flag)	3	
Angelica atropurpurea (Angelica)	6	
Ascelepias incarnata Swamp Milkweed	2	
Aster puniceus (Purple Stemmed Aster)	10	
Bidens cernua (Beggarticks)	7	
Eupatorium maculatum (Spotted Joe Pye Weed)	7	
Eupatorium perfoliatum (Boneset)	7	
Helenium autumnale (Autumn Sneeze weed)	2	
Iris virginica shrevei (Blue Flag Iris)	2	
Lobelia cardinalis (Cardinal Flower)	5	
Lobelia siphilitica (Great Blue Lobelia)	5	
Lythrum alatum (Winged Loosestrife)	2	
Physostegia virginiana (False Dragonhead)	5	
Polygonium coccinium (Smartweed)	10	
Polygonum amphibium (Water Smartweed)	10	
Pychanthemum virginianum (Mountain Mint)	5	
Rudbeckia laciniata (Cut-leaf Coneflower)	5	
Solidago riddellii (Riddell Goldenrod)	2	
Sparganium eurycarpum (Giant Burreed)	5	

CLASS – TYPE	SEEDS	KG/HECTARE(LB/ACRE)
6 Conservation Mixture	Smooth Brome Grass	45 (40)
	Vernal Alfalfa 2/	15 (15)
	Oats, Spring	55 (48)
6A Salt Tolerant Conservation Mixture	Smooth Brome Grass	45 (40)
	Vernal Alfalfa 2/	15 (15)
	Oats, Spring	55 (48)
	Fults Salt Grass 1/	25 (20)
7 Temporary Turf Cover Mixture	Perennial Ryegrass	55 (50)
	Oats, Spring 4/	70 (64)

Note 1. Fults pucinnellia distans
Note 2. Legumes - inoculation required
Note 3. Specific variety as shown in the plans or approvedby the Engineer.
Note 4. Other seeds may be used if approved by the Engineer.
Note 5. PLS = Pure Live Seed to be used
Note 6. Fertilizer not required
Note 7. Planting times April 1st to June 1st and August 15th to September 30th
Note 8. Planting times May 15th to June 30th and October 15th to December 1st.

Variation in the Class 4 or 5 seed quantities or varieties will be allowed in the event of a crop failure or other unforeseen conditions. The Contractor shall provide for the approval of the Engineer a written description of the changed Class 4 or 5 Mixture, the reasons for the change, and the name of the seed supplier.

250.08 Selective Mowing Stakes

Selective mowing stakes shall be installed to delineate areas to be seeded or interseeded with Class 4 or 5 mixtures. Selective mowing stakes shall be steel posts as described in Article 1081.13(a). The selective mowing stakes shall be driven into the ground to a height of 1.1 m (3 1/2 ft) above the ground at locations shown on the plans and as directed by the Engineer.

250.09 Method of Measurement.

(a) Contract Quantities. The requirement for use of contract quantities shall be according to Article 202.07(a).

(b) Measured Quantities. Seeding of the class specified and mowing will be measured in hectares (acres) of surface area seeded or mowed.

The exact locations of seeding and mowing will be determined in the field by the Engineer, and the quantities will be adjusted accordingly. Fertilizer will be measured by weight in kilograms (pounds) of actual nutrients. The percent of nutrients equals the guaranteed analysis on the bag. The

following formula will be used to determine the kilograms (pounds) of fertilizer nutrients applied:

(Total kilograms (pounds)
of mixed fertilizer)
X
(Percentage of each nutrient in the fertilizer applied)
= kilograms (pounds) of each fertilizer nutrient

Agricultural Ground Limestone will be measured by weight in metric tons (tons) of Agricultural Ground Limestone having an effective neutralizing value of 67.5 (four year base, a source correction factor of 1.0). Applied quantity shall be the plan quantity multiplied by the source correction factor. The pay quantity will be the applied quantity divided by the source correction factor.

Payment will not be made for fertilizer nutrients in excess of 103 percent or agricultural ground limestone in excess of 108 percent of the amounts specified by the Engineer.

Selective mowing stakes will be measured as each in place.

250.10 Basis of Payment. This work will be paid for at the contract unit price per hectare (acre) for SEEDING or INTERSEEDING of the Class specified; at the contract unit price per kilogram (pound) for NITROGEN FERTILIZER NUTRIENT, PHOSPHORUS FERTILIZER NUTRIENT and POTASSIUM FERTILIZER NUTRIENT; and at the contract unit price per metric ton (ton) for AGRICULTURAL GROUND LIMESTONE.

Mowing will be paid for at the contract unit price per hectare (acre) for MOWING. Only the initial mowing will be paid for. Any subsequent mowing required to obtain a height of not more than 75 mm (3 in.) or to disperse mowed material will be considered as included in the cost of the initial mowing.

Selective Mowing Stakes will be paid for at the contract unit price each for SELECTIVE MOWING STAKES. Furnishing innoculant shall be included in the contract unit price per hectare (acre) for Seeding of the class specified.

SECTION 251. MULCH

251.01 Description. This work shall consist of furnishing, transporting, and placing mulch or erosion control blanket over seeded areas.

251.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

	Item	Article/Section
(a)	Bituminous Materials	1009.01 - 1009.04, 1009.07
(b)	Mulch Material	1081.06(a)
(c)	Excelsior Blanket	1081.10(a)
(d)	Knitted Straw Mat	1081.10(b)
(e)	Heavy Duty Erosion Control Blanket	1081.10(c)
(f)	Staples	1081.10(d)

CONSTRUCTION REQUIREMENTS

251.03 Mulching Seeded Areas. Within 24 hours from the time seeding has been performed, the seeded area shall be given a covering of mulch by one of the following methods as designated on the plans. On slopes steeper than 1:3 (V:H), mulch shall be applied the same day as seeded. Mulch shall be applied uniformly at the rate specified.

(a) Method 1. This method shall consist of hand or machine application of straw mulch at the rate of 4.5 metric ton/ha (2 ton/acre). The mulch shall be loose enough to permit air to circulate but compact enough to reduce erosion. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material.

(b) Method 2. Method 2 shall consist of placing and stabilizing straw at the rate of 4.5 metric ton/ha (2 ton/acre) over seeded areas. All requirements of Method 1 must be met plus the mulch shall be thoroughly stabilized. The Contractor has the option of any of the following procedures for stabilizing the straw:

(1) Procedure one shall consist of partially coating the mulch with emulsified asphalt.

The coated straw shall be placed by equipment which will blow or eject, by means of constant air stream, controlled quantities of the straw and emulsified asphalt in a uniform pattern over the specified area. If the straw is excessively cut or broken, the Contractor shall take measures to reduce the cutting or breakage to a limit approved by the Engineer.

The emulsified asphalt shall be introduced into the air stream of the machine by means of a spray that will partially coat the straw with a spotty asphalt tack. The rate of application of emulsified asphalt shall be 300 L/metric ton (75 gal/ton) of straw.

(2) Procedure 2 shall consist of anchoring the straw into the soil by means of a mechanical stabilizer with dull blades or disks. These blades or disks shall be without camber, approximately 500 mm (20 in.) in diameter, notches spaced at approximately 200 mm (8 in.) intervals and equipped with scrapers. The stabilizer shall measure approximately 450 kg (1000 lb), have a working width not exceeding 1.8 m (72 in.) and

shall be equipped with a ballast compartment, so that when directed, mass (weight) can be increased.

(3) Procedure 3 shall consist of stabilizing the straw with an approved mulch blower followed immediately by an overspray application of hydraulic mulch. The hydraulic mulch shall be applied as a slurry of 850 kg (750 lb) of mulch and 9500 L (1000 gal) of water per hectare (acre) by an approved hydraulic mulch applicator. The hydraulic mulch slurry shall be agitated a minimum of five minutes before application and shall be agitated during application.

(4) Procedure 4 shall consist of stabilizing the straw mulch using an approved mulch blower with chemical mulch binder simultaneously with the straw as in Procedure 1, above, or with chemical mulch binder applied as an overspray according to Procedure 3. The chemical mulch binder shall be approved by the Engineer and shall be applied at the rate and in the manner recommended by the supplier and approved by the Engineer.

(c) Method 3. This method shall not be used on slopes steeper than 1:3(V:H). This method shall consist of machine application of wood or paper fiber hydraulic mulch at the specified rate using an approved hydraulic seeder. The hydraulic mulch shall be applied as a slurry of 2.25 metric tons (2000 lb) of mulch and not less than 19000 L (2000 gal) of water/hectare (acre). The hydraulic mulch slurry shall be agitated a minimum of five minutes before application. The seeding shall not be applied concurrently with this operation.

Following the mulching operation, foot and vehicular traffic, or the movement of equipment over the mulched area shall be prohibited. At any location where mulching has been displaced by any Contractor's equipment or personnel, the seeding and mulch or other work damaged as a result of that displacement shall be repaired or replaced immediately at the Contractor's expense, in a manner satisfactory to the Engineer.

251.04 Erosion Control Blanket. Erosion control blanket may be placed using either excelsior blanket or knitted straw blanket. The blanket shall be placed within 24 hours after seeding operations have been completed on the areas specified. Prior to placing the blanket, the areas to be covered shall be relatively free of rocks or clods over 40 mm (1 1/2 in.) in diameter, and sticks or other foreign material which will prevent the close contact of the blanket with the seed bed. If, as a result of rain, the prepared seed bed becomes crusted or eroded, or if eroded places, ruts or depressions exist for any reason, the Contractor shall to rework the soil until it is smooth and to reseed such areas which are reworked. After the area has been properly shaped, fertilized and seeded, the blanket shall be laid out flat, evenly and smoothly, without stretching the material.

The blankets shall be placed so that the netting is on the top and the fibers are in contact with the soil. For placement in ditches, the erosion control blanket shall be unrolled parallel to the centerline of the ditch so that there are no longitudinal seams within 600 mm (2 ft) of the bottom centerline of the ditch. In ditches, six staples shall

be installed at uniform spacing across the upstream end of each roll. Placing and anchoring the blankets in ditches and on slopes shall be as follows:

(a) Excelsior Blanket. For placement in ditches, the blankets shall be applied in the direction of the flow of the water and butted snugly against each other. The blankets shall be stapled in place, using six staples across the upstream end at the start of each roll and placing staples on 1.2 m (4 ft) centers along each side. A common row of staples shall be used along seams of adjoining blankets. Another roll of staples shall be used in the center of each roll and be alternately spaced between each side staple at 1.2 m (4 ft) centers. All seams shall overlap at least 50 mm (2 in.).
On slopes, the blankets shall be applied either horizontally or vertically to the contour and stapled in place similar to ditch application except that the space interval shall be 1.8 m (6 ft).

(b) Knitted Straw Blanket. The rolls shall be butted snugly together and stapled in place. The staples shall be driven through the blanket vertically into the ground for the full length. Each staple shall anchor the plastic mesh. The staples shall be spaced in a diamond pattern with the longer dimension in the direction of the slope and the shorter dimension across the slope. The longer dimension shall be a maximum of 1.8 m (6 ft) and the shorter dimension shall be a maximum of 900 mm (3 ft). A common row of staples may be used on adjoining rolls.

For placement on slopes, knitted straw blanket shall be unrolled in the direction of the slope and shall extend a minimum of 900 mm (3 ft) over the crest of the slope. On slope applications, six staples shall be installed on uniform spacing across the uphill end of each roll. The downhill ends of the lowermost rolls across the slope also shall be anchored with six staples, placed on uniform spacing.

Heavy Duty Erosion Control Blanket. This blanket shall be installed according to Article 251.04(a), except that the following stapling pattern shall be used: place six staples across the start of each roll and continue this pattern along the roll at 600 mm (2 ft) intervals. Adjacent blankets shall overlap 50 mm (2 in.), and the edge staples shall penetrate both blankets. The center two staples shall be alternately spaced between each side staple. Staples shall be as specified in Article 1081.10(d) except that the legs shall be 200 mm (8 in.) or longer.

251.06 Method of Measurement.

(a) Contract Quantities. The requirement for use of contract quantities shall be according to Article 202.07(a).

(b) Measured Quantities. Mulch Methods 1, 2, and 3 will be measured for payment in hectares (acres) of surface area mulched. Erosion Control Blanket and Heavy Duty Erosion Control Blanket will be measured for payment in place in square meters (square yards) of actual surface area covered.

251.07 Basis of Payment. This work will be paid for at the contract unit price per hectare (acre) for MULCH, METHOD 1; MULCH, METHOD 2; or MULCH; METHOD 3; and at the contract unit price per square meter (square yard) for EROSION CONTROL BLANKET or HEAVY DUTY EROSION CONTROL BLANKET.

SECTION 252. SODDING

252.01 Description. This work shall consist of preparing the ground surface and furnishing and placing sod and other materials required in the sodding operations.

252.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Sod	1081.03
(b) Salt Tolerant Sod	1081.03
(c) Agricultural Ground Limestone	1081.07
(d) Fertilizer	1081.08

CONSTRUCTION REQUIREMENTS

252.03 Ground Preparation. The area to be sodded shall be finished according to Section 212 before sodding operations are begun. Immediately prior, but not in excess of 24 hours before the sod is placed, the soil surface shall be worked until it is free from debris, washes, gullies, clods and stones. The surface shall be worked to a depth of not less than 75 mm (3 in.) with a disk, tiller or other equipment approved by the Engineer. Prepared surface shall be finished to a fine smooth finish free of irregularities. Finished ground elevations shall allow for the thickness of sod to match grade of existing turf or structures.

All soil surfaces shall be moist when the sod is placed. When directed by the Engineer, the Contractor shall be required to apply water to dry soil surfaces at a minimum rate of 5 L/sq m (1 gal/sq yd) immediately prior to placing the sod.

When specified, agricultural ground limestone and fertilizer nutrients shall be applied at the designated rates over the areas to be sodded.

When fertilizer is specified, 210 kg (180 lb) of fertilizer nutrients per hectare (acre) shall be applied over the areas to be sodded at a 1:1:1 ratio as follows:

Nitrogen Fertilizer Nutrients	70 kg/ha (60 lb/acre)
Phosphorus Fertilizer Nutrients	70 kg/ha (60 lb/acre)
Potassium Fertilizer Nutrients	70 kg/ha (60 lb/acre)

252.04 Sodding Time. Sod shall be placed when the ground is in a workable condition and temperatures are less than 26 ºC (80 ºF). Sod shall not be placed when the sod or ground surface is frozen.

252.05 Transportation. All sod shall be properly protected during transportation to maintain it in a live, healthy condition. Sod cut for more than 48

hours shall only be used with the approval of the Engineer. Any sod that has dried out, has heated to over 38 ºC (100 ºF), or is frozen prior to placing will be rejected and shall be immediately removed from the jobsite by the Contractor.

252.06 Placing Sod. The sod shall be placed on the prepared surface with the edges in close contact and alternate courses staggered.

In ditches, the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground. The exposed edges of sod shall be buried flush with the adjacent soil.

On slopes where the sod may be displaced during sodding operations, the workmen shall work from ladders or treaded planks.

252.07 Staking Sod. The sod shall be staked on all slopes of 1:2(V:H) or steeper. Sod shall be staked with not less than four stakes per sq m (sq yd) with at least one stake for each piece of sod. Stakes shall be a minimum of 150 mm (6 in.) long. Stakes shall be installed so that they hold the sod firmly in place yet present no danger to pedestrians or mowing crews. The type of stake and the method of installation shall meet the approval of the Engineer.

252.08 Sod Watering. Within two hours after the sod has been placed, water shall be applied at a rate of 25 L/sq m (5 gal/sq yd). When the sod is placed between September 1st and May 30th, additional water shall be applied every five days at the rate of 15 L/sq m (3 gal/sq yd) for a total of seven additional waterings. When the sod is placed between June 1st and August 31st, additional water shall be applied every three days at a rate of 15 L/sq m (3 gal/sq yd) for a total of 15 additional waterings.

The Contractor shall have on hand enough equipment to completely water all sodded areas in two days at the watering rates specified above. The Engineer will make periodic checks of the Contractor's watering equipment to determine its adequacy and operating condition.

All watering described shall be done with a spray application. An open end hose will not be acceptable. The method of watering shall meet the approval of the Engineer.

252.09 Supplemental Watering. During periods exceeding 26º C (80º F) or subnormal rainfall, supplemental watering may be required after the initial and additional waterings and prior to acceptance of the work. Supplemental watering shall be performed when directed by the Engineer. Water shall be applied at the rate specified by the Engineer within 24 hours of notice.

252.10 Disposal of Surplus Material. Surplus and waste materials resulting from sodding operations shall be disposed of by the Contractor according to Article 202.03.

252.11 Inspection. The Contractor shall notify the Engineer of the localities from which the sod is to be obtained so that an authorized representative may inspect the fields for approval.

A copy of the inspection certificate required by law to this effect shall accompany each shipment and on arrival shall be filed with the Engineer.

With every shipment of Salt Tolerant Sod, the Contractor shall provide to the Engineer a letter of certification from an authorized representative of the nursery stating that the seed mixture used in the sod conforms to the specifications.

252.12 Method of Measurement. Sodding will be measured for payment in place and the area computed in square meters (square yards). To be acceptable, the sod shall be growing in place for a minimum of 45 days in a live, healthy condition and be knitted to the soil. When directed by the Engineer, any defective or unacceptable sod shall be removed, replaced and watered by the Contractor at his/her own expense. Only acceptable sod will be measured for payment.

Sod watering will not be measured for payment.

Supplemental watering will be measured for payment in units of 1000 L (1000 gal) of water applied on the sodded areas.

Fertilizer will be measured for payment according to Article 250.08.

Agricultural Ground Limestone will be measured for payment according to Article 250.08.

252.13 Basis of Payment. Sodding will be paid for at the contract unit price per square meter (square yard) for SODDING or SODDING, SALT TOLERANT.

Supplemental watering will be paid for at the contract unit price per unit for SUPPLEMENTAL WATERING.

Fertilizer and Agricultural Ground Limestone will be paid for according to Article 250.09.

SECTION 253. PLANTING WOODY PLANTS

253.01 Description. This work shall consist of furnishing, transporting, and planting woody plants such as trees, shrubs, vines, and seedlings. The work shall also include all mulching, bracing, wrapping, watering, weeding, replacement of plants when required, and all work described.

253.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Trees, Shrubs, Vines and Seedlings	1081.01
(b) Topsoil	1081.05(a)
(c) Mulch Material	1081.06(b)
(d) Bracing	1081.13
(e) Weed Barrier Fabric	1081.14

CONSTRUCTION REQUIREMENTS

253.03 Planting Time. Except for container grown items, plants must be dormant when delivered to the storage site or project.

In reference to the following planting dates, that portion of the State which lies north of a line formed by the southern boundaries of Hancock, Schuyler, Mason, Tazewell, McLean, Ford, and Iroquois Counties shall be considered the northern zone, while that portion of the State which lies south of this line shall be considered the southern zone.

Bare root plant material shall be planted only when the air temperatures exceed 2 ºC (35 ºF).

(a) Spring Planting. This work shall be performed from the time the soil can be worked until the plant, under field conditions, is not dormant except that:

(1) Evergreen planting shall end April 1 in the southern zone and April 30 in the northern zone.

(2) Seedlings, broadleaf evergreens, vines and willow (Salix spp.), poplar (Populus spp.), oak (Quercus spp.), alder (Alnus spp.), birch (Betula spp.), hawthorn (Crataegus spp.), red maple (Acer Rubrum), cherry (Prunus spp.), and pear (Pyrus spp.) species shall be planted only during the spring planting season.

(3) The planting time may be extended for container grown plants if the Engineer determines that the weather conditions are favorable.

(b) Fall Planting. This work shall be performed from the time the plant becomes dormant until the ground cannot be satisfactorily worked except that evergreen planting shall be performed between August 15 and October 15 in the northern zone and between September 1 and November 1 in the southern zone.

All plant material not planted according to the specified seasonal date shall require prior written approval from the Engineer. Failure to secure such approval shall result in the rejection of the plant material and replacement by the Contractor at his/her expense.

253.04 Digging of Plants. Plants shall not be dug until the Contractor is ready to transport them from their original locations to the site of the work or approved storage. The maximum time lapse between digging and being properly loaded, as defined in Article 1081.01 for delivery to the site of the work or being placed in approved storage, shall be four days for balled or burlapped plants and one day for bare root plants. They shall be dug with care, avoiding injury to the plants or loss or damage of the roots, particular attention being given to fibrous roots. Immediately after digging, roots shall be protected against drying out and freezing. Bare root plants shall be dug only when air temperatures exceed 2 ºC (35 ºF).

253.05 Transportation. During transportation, the Contractor shall exercise care to prevent injury and drying out of the plants. Upon arrival at the temporary

storage location or the site of the work, plants will be inspected for proper shipping procedures as defined in Article 1081.01(d). Should the roots be dried out, large branches be broken, balls of earth be broken or loosened, or areas of bark be torn, the Engineer may reject the injured tree. When a tree has been so rejected, the Contractor shall at once remove it from the area of the work and replace it.

253.06 Temporary Storage. No plant shall remain in temporary storage over the summer. Plants delivered to the project that are not to be planted immediately shall be protected in the following manner:

(a) Bare Root Plants. Plants may remain on the site of the work only 24 hours prior to being planted or placed in storage. During this 24 hour period, the Contractor shall continue to exercise care to prevent injury and drying out of the plants. The roots of plants to be placed in storage shall first be puddled in a paste solution of topsoil and water. The plants shall then be protected and kept moist by "heeling-in" the roots or by placing the plant in a cool moist storage building. The "heeling-in" procedure shall require the plants to be separated and the roots heeled in a suitable moist soil. If plants are stored in a building, the roots shall be covered with a suitable moist mulch. Winter storage of bare rooted plants will be allowed only in temperature and humidity controlled buildings. The Engineer shall approve the storage methods. The duration of storage, the method of storage and the materials used for mulch and "heeling-in" shall meet with the approval of the Engineer.

(b) Balled and Burlapped Plants and Container Grown Plants. Plants may remain on the site of the work only 72 hours prior to being planted or placed in storage.

Balled and burlapped plants shall be kept moist and their solidity carefully preserved. To prevent drying out or freezing, they shall be stored either in a cool moist storage building or placed in a compact group with a suitable mulch material placed around and between the balls so they are completely covered.

Container grown plant material shall be kept moist by watering as directed by the Engineer. To prevent freezing, they shall be stored either in a cool moist storage building or placed in a compact group with a suitable mulch material placed around and between the containers so that they are completely covered.

The duration of storage, method of storage and mulch material for balled and burlap material and container grown plant material shall meet the approval of the Engineer.

253.07 Layout of Planting. The area to be planted shall be finished to line and grade before planting operations are begun. The Contractor shall furnish all marking flags for locating plants and shall mark the common name of plants. The Engineer will place the marking flags and outline each area for mass or solid planting. Where seedlings are to be planted the planting areas shall be delineated with selective mowing stakes. Selective mowing stakes shall be according to Article 250.08.

253.08 Excavation of Plant Holes. The sides of all plant holes shall be saucer shaped with the proportions being the width equal to three times the depth. On slopes, the depth of excavation will be measured at the center of the hole. The excess material excavated from the holes shall be spread in the immediate area as directed by the Engineer. The excavated material shall not be stockpiled on turf or in ditches. The sides of holes shall not be glazed or smooth.

(a) Excavation for Trees. Holes for trees shall be dug at the location indicated by the marking flags. The diameter and depth of the hole shall be according to the following chart:

PLANT MATERIAL SIZE	MINIMUM DIAMETER OF BALL (W)	MINIMUM BALL DEPTH (D)	PLANTING HOLE WIDTH (3W)
1.2 m (4') < 2.4 m (8 ft) (height)	355 mm (14 in.) <560 MM (22 in.) Shrubs	270 mm (10.5 in.) <370 mm (14.5 in.) Shrubs	1070 mm (42 in.) < 1680 mm (66 in.) Shrubs
2.4 m (8 ft) < 3.6 m (12') (height)	400 mm (16 in.) <700 mm (28 in.) Evergreens	300 mm (12 in.) < 470 mm (18.5 in.) Evergreens	1220 mm (48 in.) < 2140 mm (84 in.) Evergreens
25 mm (1 in.) < 50 mm (2 in.) (diameter)	560 mm (22 in.) < 960 mm (38 in.) Shrubs	370 mm (14.5 in.) < 585 mm (23 in.) Shrubs	1680 mm (66 in.) < 2900 mm (114 in.) Shrubs
50 mm (2 in.) < 75 mm (3 in,) (diameter)	700 mm (28 in.) < 960 mm (38 in.) Evergreens	300 mm (12 in.) < 585 mm (23 in.) Evergreens	2140 mm (84 in.) < 2900 mm (114 in.) Evergreens
75 mm (3 in.) < 100 mm (4 in.) (diameter)	400 mm (16 in.) < 600 mm (24 in.)	300 mm (12 in.) < 400 mm (16 in.)	1220 mm (48 in.) < 1830 mm (72 in.)
100 mm (4 in.) < 125 mm (5 in.) (diameter)	600 mm (24 in.) < 775 mm (31 in.)	400 mm (16 in.) < 495 mm (91.5 in.)	1830 mm (72 in.) < 2300 mm (93 in.)
125 mm (5 in.) or larger (diameter)	775 mm (31 in.) < 1070 mm (42 in.)	495 mm (19.5 in.) < 635 mm (25 in.)	2300 mm (93 in.) < 3200 mm (126 in.)
	1070 mm (42 in.) < 1340 mm (53 in.)	635 mm (25 in.) < 780 mm (32 in.)	3200 mm (126 in.) < 4000 mm (150 in.)
	1340 mm (53 in.) < or larger (diameter)	780 mm (32 in.) < or larger (diameter)	4000 mm (150 in.) or larger (diameter)

(b) Excavation for Shrubs, Vines, and Seedlings. Holes for shrubs, vines, and seedlings shall be dug within the marked outline of the planting bed. The spacing of planting will be designated on the plans. Spacing shall be measured from center-to-center and alternate rows shall be staggered.

Prior to digging shrub and vine holes, existing vegetation on the area shall be mowed or treated with a non-selective, post emergent non-residual

herbicide approved by the Engineer. The area shall then be tilled to a minimum depth of 50 mm (2 in.) until free of debris, gullies, clods, weeds, stones, and roots.

Holes for shrubs shall be dug to a minimum diameter equal to three times the root ball diameter and equal to the root ball depth. Holes for vines shall be dug to a minimum diameter of 200 mm (8 in.) and depth of 200 mm (8 in.).

Immediately prior to planting seedlings, the existing grass and weed growth within the planting area shall be cut to a maximum height of 50 mm (2 in.). On slopes flatter than 1:3(V:H), the soil adjacent to the plant row parallel to the contour shall be prepared by cultivating or scalping to remove all grass and weed growth, in a continuous strip not less than 450 mm (18 in.) wide. The seedlings shall be planted in the center of this strip.

Holes for seedlings shall be made large enough to accommodate the root system with a spade, planting bar or an approved mechanical tree planting machine. Individual holes for container grown plants shall be excavated to the same dimensions for comparable size balled and burlapped material.

253.09 Pruning. All pruning shall be performed by a professional arborist. Pruning shall be done in the presence of the Engineer and in such a manner as to preserve the natural growth habit of each plant. All pruning shall be done in conformance with National Arborists Association Pruning Standards for Shade Trees Class 1 - Fine Pruning.

The ends of all broken and damaged roots of 6 mm (1/4 in.) or larger shall be pruned with a clean cut, removing only the injured portion. All broken branches, stubs and improper cuts of former pruning shall be removed.

(a) Deciduous Trees. Pruning shall consist of thinning the twigs or branches as dictated by the habit of growth of the various types of the trees to be pruned, and as directed by the Engineer. The leader and terminal buds shall not be cut unless directed by the Engineer.

(b) Deciduous Shrubs. In general, shrubs shall be cut back to half of their height. Shrubs that are slow growing or do not sucker readily shall be pruned in the same manner as deciduous shade trees.

(c) Evergreens. Evergreens shall not be pruned except to remove broken or dead branches.

253.10 Planting Procedures. When directed by the Engineer, the backfill shall consist of suitable soil removed from the hole and topsoil as needed to match the level of the existing grade. If the existing soil is determined to be unsuitable, the backfill shall consist of topsoil as approved by the Engineer. Topsoil shall be stockpiled only at locations approved by the Engineer.

The backfill soil at the time of planting shall be capable of providing a sound growth environment and be in a loose, friable condition. At no time shall the backfill or other topsoil used on the job be stockpiled on turf or in ditches.

All plants shall be placed in a plumb position and set 50 mm (2 in.) higher than the depth they grew in the nursery. Prepared backfill shall be placed around the root system. Tamping or watering shall accompany the backfilling operation to eliminate air pockets.

Thorough watering of trees, shrubs, and vines, with a method approved by the Engineer, shall immediately follow the backfilling operation. This watering shall completely saturate the backfill and be performed during the same day of planting. After the ground settles, as a result of the watering, additional backfill shall be placed to match the level of the finished grade. Approved watering equipment shall be at the site of the work and in operational condition prior to starting the planting operation.

(a) Balled and Burlapped Plants. After the plant is placed in the hole, all cords and burlap shall be removed from the trunk. Wire baskets shall be removed from at least the upper one half of the planting ball. All materials shall be disposed of properly.

(b) Container Grown Plants. Prior to placing the plant in the hole, the container shall be removed with care so as not to disturb the ball of soil that contains the root system. During the planting operation, care shall be taken not to destroy the solidity of the ball of soil. Pots which will decompose in one growing season shall be removed to a point just below the surface of the ground.

(c) Bare Root Plants. The roots shall be carefully spread in a natural position and prepared backfill shall be worked in around the roots so each root is individually packed to eliminate air pockets. The plant shall be gently raised and lowered to assure contact of the roots with the soil.

(d) Seedling Plants. When seedlings are removed from storage for planting, they shall be transported to the planting site in containers of water and the roots shall be continuously immersed until planted. Any unplanted seedlings left at the end of each day shall be removed from the water, the roots wrapped in moist materials and the seedlings placed in storage.

    (1) If holes are prepared according to Article 253.08, the roots shall be placed in the center of the hole and the backfill shall be compacted around the roots to eliminate air pockets. The backfill shall be saturated with water after the plant is placed.

    (2) If an approved tree planting machine or a hand method that utilizes a planting bar or spade is used, no backfill will be required.

(e) Water Saucer. All plants, except seedlings, placed individually and not specified to be bedded with other plants, shall have a water saucer constructed of soil equal to one half the diameter of the planting hole width and 100 mm (4 in.) in depth.

253.11 Mulch Cover. Within 30 days after planting, weed barrier fabric shall be placed around all plants and covered with mulch in the entire mulched bed or saucer area specified. Weed barrier and mulch will not be required for seedlings.

The fabric shall be cut as needed and fitted around the plant material. Wire staples, meeting the approval of the Engineer and driven at a 90 degree angle to the plane of the soil, shall be installed to hold the fabric in place. A minimum of one staple per square meter (square yard) is required. Strips of fabric shall overlap 150 mm (6 in.) at the seams. After placing the weed barrier fabric, the top surface. of the fabric shall be clear of any topsoil and mulch shall be placed in such a way as to completely cover the weed barrier to a depth of 100 mm (4 in.).

253.12 Wrapping. Within seven days after planting, a double layer of commercial screen wire mesh shall be wrapped around the trunk of all deciduous trees. All other plants planted individually shall be similarly wrapped when directed by the Engineer. The screen wire shall be secured to itself with staples or single wire strand tied to the mesh. The lower edge of the screen wire shall be in continuous contact with the ground and shall extend up to the lowest major branch.

253.13 Bracing. All deciduous and evergreen trees over 2.5 m (8 ft) in height shall require three 2.5 m (8 ft) long steel posts so placed that they are equidistant from each other and adjacent to the outside of the ball. The posts shall be driven vertically to a depth of 450 mm (18 in.) below the bottom of the hole. The anchor plate shall be aligned perpendicular to a line between the tree and the post. The tree shall be firmly attached to each post with a double guy of 2.03 mm (14 gauge) steel wire. The portion of the wire in contact with the tree shall be encased in a hose of a type and length approved by the Engineer.

During the life of the contract, if trees blow down, or are otherwise injured because of improper bracing, the Engineer may reject such injured trees, and the rejected trees shall be replaced by the Contractor at his/her own expense.

253.14 Period of Establishment. Partial inspections of planting work as specified in Article 105.13, will not be made unless the planting work is unavoidably detained due to uncompleted highway construction that must precede the planting operation. Inspection for the successful completion of the period of establishment will be made during the month of September each year. To qualify for inspection, the Contractor must receive written certification from the Engineer stating that all specified plant material was in place and in a live healthy condition on or before June 1 of the year of inspection. To be acceptable, the plant must be in a live healthy condition, representative of its species. No portion of this work will be inspected until all items of work are completed.

This delay in inspection and acceptance of plant material shall not delay acceptance of the entire project and final payment due if the Contractor provides the Department with a surety bond in the full amount of all plant material items listed in the contract. The bond shall be executed prior to acceptance and final payment of the non-plant material items and shall be in full force and effect until final inspection and acceptance of all plant material including replacements.

The Department will assume the responsibility for all plant material found to be satisfactory at the time of inspection for successful completion of the period of establishment. Plants that do not meet the requirements for acceptance shall be replaced by the Contractor at his/her own expense following the date of inspection and prior to November 30. Items specified for spring planting only shall be planted

prior to the following April 30. Changes in the above dates will be allowed by the Engineer only if extreme weather conditions or other mitigating circumstances so dictate. When replacements are completed, the Contractor shall weed and thoroughly clean up the entire job to the satisfaction of the Engineer. Cleanup shall include pruning dead branches off the accepted plant material, spraying insect infected plants, removing staking and screening material, weeding, restoring mulch, removing work-related debris and generally cleaning up the work site. When clean up operations have been completed, inspection will be made for replacement items only. All replacement items shall meet and be planted according to the original job specifications. Replacement plantings need not undergo a period of establishment to be accepted. However, replacement plants must be properly installed and in a live healthy condition at the time of inspection. Should replacements include both spring and fall items, the Contractor may elect to plant all replacements in the spring, prior to May 15.

The Contractor shall remove immediately from the site of the work any dead plant material. During spring or fall planting, the Contractor will not be permitted to terminate the operation until all plant material is in a live, healthy condition. All plant material which dies within 15 days after being planted shall be replaced at that time and shall be considered as part of the original planting and be subject to the requirements of the period of establishment.

253.15 Plant Care. During the period of establishment, the Contractor shall properly care for all plants including weeding, watering, adjusting of braces, repair of water saucers or other work which is necessary to maintain the health and satisfactory appearance of the plantings. All requirements for proper care during the period of establishment shall be considered as included in the cost of the contract and shall be performed within five days following notification by the Engineer.

(a) During the period of establishment, additional watering shall be performed at least once within every 30 days during the months of May through December. The Engineer may direct the Contractor to adjust the watering rate and frequency depending upon weather conditions.

The water shall be applied to individual plants in such a manner that the plant hole shall be saturated without allowing the water to overflow beyond the earthen saucer. Watering of plants in beds shall be applied in such a manner that all plant holes are uniformly saturated without allowing the water to flow beyond the periphery of the bed. The plants to be watered and the method of application will be approved by the Engineer. The Contractor will not be relieved in any way from the responsibility for unsatisfactory plants due to the amount of watering.

(b) During the period of establishment, weeds and grass growth shall be removed from within the earthen saucer of individual trees and from the area within the mulched plant beds. This weeding shall be performed twice during each of the months of May through September. The Contractor will not be relieved in any way from the responsibility for unsatisfactory plants due to the extent of weeding.

The weeding may be performed in any manner approved by the Engineer provided the weed and grass growth, including their roots and stems, are

removed from the area specified. Mulch disturbed by the weeding operation shall be replaced to its original condition. All debris which results from this operation must be removed from the right of way at the end of each day.

253.16 Method of Measurement. Trees, shrubs, and vines will be measured for payment in place as individual plants. Seedlings will be measured for payment in units of 100 plants in place. Only acceptable plants will be measured for payment.

253.17 Basis of Payment. This work will be paid for at the contract unit price each for several kinds and sizes of TREES, SHRUBS, and VINES, and per unit for SEEDLINGS.

SECTION 254. PLANTING PERENNIAL PLANTS

254.01 Description. This work shall consist of furnishing, transporting, and planting perennial plants.

254.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

	Item	Article/Section
(a)	Bulbs and Tubers	1081.02(a)
(b)	Herbaceous Plants	1081.02(b)
(c)	Mulch Material	1081.06(b)

254.03 Types and Mixtures.

(a) Bulbs. Bulbs shall be of the color and variety specified.

(b) Ornamental Herbacious Plants. Ornamental herbacious plants shall be of the color and variety specified. Bare root plants may be used if installed in the spring prior to the normal budding time of the plant. Potted plants shall be used when specified on the plans or directed by the Engineer.

(c) Prairie Type Plants. The following mixture shall be used:

Prairie Type. A random mixture consisting of no more than 20 percent of any one of the species.

Aster laevis - Smooth Aster
Baptisia leucantha - White Wild Indigo
Echinacea pallida - Pale Purple Coneflower
Eryngium yuccifolium - Rattlesnake Master
Liatris pyscostachya - Gayfeather
Monarda fistulosa - Wild Bergamont
Ratibida pinnata - Yellow Coneflower
Rudbeckia hirta - Black-eyed Susan
Silphium terebinthinaceum - Prairie Dock
Tradescantia ohiensis - Spiderwort

(d) Wetland Type Plants. The following mixtures shall be used:

Wetland Emergent Type. An equal number of each of the following species:

0 to 150 mm (0 to 6 in.) Water Depth Plants

Acorus calamus - Sweet Flag
Iris virginica shrevei - Blue Flag Iris
Polygonum coccineum - Marsh Smartweed
Sagittaria latifolia - Arrowhead
Sparganium eurycarpum - Large Fruited Burreed

150 to 300 mm (6 to 12 in.) Water Depth Plants

Nuphar advena - Yellow (Spatterdock) Water-lily
Nymphaea tuberosa - White (Tuberous) Water-lily
Pontederia cordata - Pickerelweed
Sagittarium rigida - Sessile-fruited Arrowhead
Scirpus acutus - Hardstem Bulrush

(e) Sedge Meadow Type. The following mixtures shall be used.

Sedge Meadow Type. A random mixture consisting of no more than 20 percent of any one of the species.

Calamagrostis canadensis - Blue Joint Grass
Carex lacustris - Lake Bank Sedge
Carex hystricina - Bottle Brush Sedge
Carex stricta - Tussock Sedge
Juncus tenuis - Path Rush
Scirpus fluviatilis - River Bulrush
Spartina pectinata - Prairie Cord Grass

(f) Woodland Type Plants. The following mixture shall be used:

Woodland Type. A random mixture consisting of no more than 20 percent of any one of the species.

Aquilegia canadensis - Columbine
Arisaema triphyllum - Jack-In-The-Pulpit
Delphinium tricorne - Wild Larkspur
Dicentra cucullaria - Dutchman's Breeches
Dodecatheon meadia - Shooting Stars
Geranium maculatum - Wild Geranium
Hydrophyllum virginianum - Virginia Waterleaf
Mertensia virginica - Bluebells
Phlox divaricata - Blue Phlox
Polemonium reptans - Jacob's Ladder
Sangiunaria canadensis - Bloodroot
Smilacina racemosa - False Solomon's Seal
Tradescantia ohiensis - Spiderwort
Uvularia grandflora - Yellow Bellwort

254.04 Planting Time. Planting times for the various types of perennial plants shall be as follows:

(a) Bulbs. Bulbs shall be planted between October 15 and November 15.

(b) Ornamental Herbacious Plants, Prairie Type Plants, Wetland Emergent Type Plants, and Sedge Meadow Type Plants shall be planted between May 1 and June 15 or between August 15 and September 15.

(c) Woodland Type Plants shall be planted between April 1 and May 15.

254.05 Transporting and Storing Plants. The Engineer will inspect the plants and bulbs at the work site at the beginning of each planting day and reject any material that is not properly packaged (including clear labeling by species) or that is not in a firm, moist, or viable condition. Any plants remaining at the end of the day shall be removed from the work site and properly stored by the Contractor.

Before planting, sufficient water shall be added to potted plants to insure that the soil around the roots is not dry and crumbly when the plants are removed from the pots.

254.06 Layout of Planting. When plants are specified to be planted in prepared soil planting beds, the planting bed shall be approved by the Engineer prior to planting. If no prepared soil planting bed is specified, the plants shall be planted in areas that have existing cover or have been seeded and mulched or sodded. Where perennial plants, except bulbs, shall be planted, the planting beds shall be delineated with selective mowing stakes. Selective mowing stakes shall be according to Article 250.08.

254.07 Planting Procedures. The spacing of the plants shall be as shown on the plans or as directed by the Engineer, to uniformly fill the planting beds. Individual plants within the beds shall be planted as follows:

(a) Bulbs. Bulbs shall be planted to a depth of 150 mm (6 in.) in turf areas or prepared beds.

(b) Ornamental Herbacious Plants, Prairie Type Plants, Sedge Meadow Type Plants and Woodland Type Plants. When planted in prepared soil planting beds, these plants shall be planted by a hand method approved by the Engineer.

When planted in existing turf, the planting area shall be mowed to a maximum height of 50 mm (2 in.).

In existing cover or seeded and mulched or sodded planting areas, a 300 mm (12 in.) diameter planting area for individual plants shall be prepared. The existing cover or seed and mulch shall be cut and removed from the 300 mm (12 in.) diameter planting area and the soil within the planting area loosened to a depth of 150 mm (6 in.). The plants shall be planted within the planting area and immediately watered with at least 5 L (1 gal) of water per plant.

254.08 Mulching. Within 24 hours, the plants shall be mulched with 50 mm (2 in.) of a fine grade mulch meeting the approval of the Engineer. Care shall be taken to place the mulch in a way that does not smother the plants. When plants are planted in prepared soil planting beds, the entire bed shall be mulched. Bulbs planted in existing turf need not be mulched.

254.09 Period of Establishment.

(a) No period of establishment will be required for bulbs.

(b) Perennial plants must undergo a 30 day period of establishment. Additional waterings shall be performed at least once within every seven days for four weeks following installation. Water shall be applied at the rate of 9 L/sq m (2 gal/sq yd). Should excess moisture prevail, the Engineer may delete any or all of the additional watering cycles. In severe weather, the Engineer may require additional waterings.

Watering of plants in beds shall be applied in such a manner that all plant holes are uniformly saturated without allowing the water to flow beyond the periphery of the bed.

At the end of the period of establishment, the Contractor will be permitted to replace any unacceptable plants and shall thoroughly weed all the beds.

254.10 Method of Measurement. This work will be measured for payment in units of 100 perennial plants of the type specified. Measurement for payment of this work will not be performed until at the end of the 30 day establishment period for the replacement planting. Only plants that are in place and alive at the time of measurement will be measured for payment except that if fewer than 25 percent of the plants are acceptable, a quantity equal to 25 percent of the number of units of plants originally planted will be considered measured for payment.

Selective mowing stakes will be measured as each in place.

254.11 Basis of Payment. This work will be paid for at the contract unit price per unit for PERENNIAL PLANTS, of the type specified.

Selective mowing stakes will be paid for at the contract unit price each for SELECTIVE MOWING STAKES.

EROSION CONTROL

SECTION 280. TEMPORARY EROSION CONTROL

280.01 Description. This work shall consist of constructing temporary erosion control systems as shown on the plans, or as directed by the Engineer during the life of the contract, to control erosion and sediment damage to the roadway, adjacent properties and water resources through the use of basins, ditch checks, temporary ditches, mulch barriers, mulches, grasses, silt filter fences, and other erosion control devices or methods.

Any temporary erosion control systems ordered by the Engineer shall be coordinated with the permanent erosion control features specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post construction period.

280.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Bale Stakes	1081.15(a)
(b) Fence Stakes	1081.15(b)
(c) Hay or Straw Bales	1081.15(c)
(d) Fence	1081.15(d)
(e) Aggregate	1081.15(e)
(f) Silt Filter Fence	1080.02
(g) Temporary Mulch Material	1081.06
(h) Grass Seed	1081.04
(i) Urethane Foam/Geotextile	1081.15(f)
(j) Rolled Excelsior	1081.15(g)
(j) Temporary Erosion Control Seeding	1081.10(g)

CONSTRUCTION REQUIREMENTS

280.03 General. The Contractor and the Department shall schedule and conduct a jobsite inspection to review and designate the locations and types of erosion control protection to be placed. The Contractor shall name a person at the preconstruction meeting who shall be on the jobsite during construction and who shall be responsible for insuring the erosion control work is completed in a timely manner. The inspection shall be scheduled at the preconstruction conference. The inspection shall be carried out on the job site prior to beginning any work which will disturb existing drainage or require erosion control.

Erosion control measures as indicated in the Erosion Control Plan, and as directed by the Engineer shall be installed on the project site prior to beginning any construction activities which will potentially create erodible conditions. Erosion control devices shall be in place and approved by the Engineer as to proper placement and installation prior to beginning other work. Erosion control protection for Contractor borrow pits, equipment storage sites, plant sites, haul roads, and other

sites shall be installed by the Contractor and approved by the Engineer prior to beginning construction activities at each site.

The Engineer will direct seeding or other methods to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations, and to direct the Contractor to provide immediate permanent or temporary erosion control measures. The Contractor shall incorporate all permanent erosion control features into the project at the earliest practicable time to minimize the need for temporary controls. The Contractor shall coordinate the work so that no more than a total of 4 hectares (10 acres) is disturbed at a time. Completed slopes shall be seeded and mulched as the excavation proceeds to the extent considered desirable and practical. Permanent seeding shall be used whenever possible. Under no circumstances shall the Contractor prolong final grading and shaping so that the entire project can be permanently seeded at one time. Wherever possible permanently seeded areas shall be avoided when performing adjacent work. Seeding done outside the specified seeding dates shall be approved by the Engineer in writing.

280.04 Temporary Erosion Control Systems. This work shall constructed using natural materials such as hay or straw bales, aggregate barriers, mulch, seeding and excavated earth, or by manufactured materials and devices such as silt filter fence, erosion control blankets, rolled excelsior or urethane foam/geotextile barriers. Manufactured methods and materials shall be installed in accordance with the manufacturers' specifications unless otherwise indicated in the contract documents.

Appropriate natural or manufactured methods or materials, employed separately or in combination, other than those in this Article, may be considered for use if they perform the intended function in a manner equal to or better than those specified. The Contractor shall obtain approval in writing by the Department prior to the start of construction of those items.

(a) Temporary Ditch Checks. This system consists of the construction of temporary ditch checks to prevent siltation, erosion or scour of various ditches and drainageways. The ditch checks shall be constructed according to the standard drawings, and, where appropriate, the manufacturers' specifications. They shall also be spaced so that the low point in the center of the ditch check is at approximately the same elevation as the ground line at the ditch check immediately upstream.

Aggregate Ditch Checks shall be constructed by depositing and shaping the material as shown in standard drawings and approved by the Engineer. If the ditch check is within the clear zone and the road is open to traffic, the traffic approach slope of the aggregate shall be graded to a 1:4(V:H) slope.

Hay or straw bales shall be installed in a backfilled trench 75 mm (3 in.) deep. Where more than one row is used, the bales shall be staggered to cover joints. Where bales are to be staked, a minimum of two stakes per bale shall be used. The bales shall be placed so that the bale ties are not in contact with the ground. This work may be constructed of hay or straw bales, mulch barrier, aggregate barriers, excavation, seeding, or mulch used separately or in combination, as approved, by the Engineer. Other methods

and materials, approved in writing by the Department prior to the start of construction, may also be used.

Rolled Excelsior shall be installed in a trench 75 mm (3 in.) deep. Anchor stakes (wood or metal), shall be driven at a spacing of 600 mm (2 ft) on center, 600 mm (2 ft) into the ground. Wood stakes shall be a minimum of 25 mm (1 in.) square. Metal stakes shall be a minimum of 25 mm (1 in.) diameter. The stakes shall be 1.2 m (48 in.) in length and shall be entwined with the mesh covering of the roll on the downstream side, and angled with the direction of the flow.

Urethane foam/geotextile ditch checks shall be installed using wire staples fabricated from No. 11 gauge wire. The staples used to attach the urethane foam/geotextile ditch check to the ground shall be at least 150 to 200 mm (6 to 8 in.) long and shall be placed at the midpoints of the apron and barrier.

(b) Perimeter Erosion Barrier. This system consists of a continuous barrier adjacent to an area of construction to intercept sheet flow of water borne silt and sediment, and prevent it from leaving the area of construction. The barrier shall be constructed according to manufacturers' specifications where appropriate.

Silt Filter Fence shall be supported on posts at least 2 m (6 feet) in length, and spaced on 1.5 m (5 foot) centers. The bottom of the fabric shall be installed in a backfilled trench 150 mm (6 in.) deep, and securely attached to the post by a method approved by the Engineer. Erosion control fence may be specified to provide additional support for this installation.

Hay or straw bales, rolled excelsior, or aggregate shall be installed according to the requirements of Article 280.04(a).

(c) Inlet and Pipe Protection. This system consists of placement of protection surrounding inlets, pipe inlets or outfalls, and in similar locations as required to intercept water borne silt and sediment and prevent it from entering the drainage system or exiting the construction area. The protection shall be constructed according to the manufacturers' specifications where appropriate.

(d) Sedimentation Basins. This system consists of excavating and maintaining temporary basins at pipe inlets or outfalls, in ditches and in drainageways to capture water borne silt and prevent it from exiting the construction area. The outfall of these basins is usually protected by perimeter erosion barrier to capture remaining silt.

(e) Temporary Ditches. This system consists of constructing temporary ditches to intercept water borne silt and runoff at locations designated on the plans or directed by the Engineer.

(f) Temporary Erosion Control Seeding. This system consists of seeding all erodable / bare areas every seven days to minimize the amount of exposed surface area within contract limits. Seed shall be according to Article 1081.04 and shall consist of Oats from March 1 to July 31 and Winter Wheat

from August 1 to November 15. Seed bed preparation shall not be required if the soil is in a loose condition. Light disking shall be done if the soil is hard packed or caked. Fertilizer nutrients will not be required. The original bags shall be opened in the presence of the Engineer, and the seed shall be applied by hand broadcasting or as directed by the Engineer, to achieve a reasonably uniform coverage at a rate of 110 kg/ha (100 lb/acre) Seed shall be applied to all bare areas within contract limits every seven days, regardless of weather conditions or progress of the work, unless otherwise directed by the Engineer. The Engineer may require that critical locations be seeded immediately, the Contractor shall seed these areas within 48 hours of such a directive.

(g) Temporary Mulch. This system consists of installing temporary mulch cover over designated areas of the right of way to prevent sheet erosion of areas that are to be altered during a later construction phase. The temporary mulch cover shall conform to the requirements of Section 251 for Mulch, Method 1 or Method 2.

280.05 Maintenance. The temporary erosion control systems installed by the Contractor shall be properly maintained as directed by the Engineer to control siltation at all times during the life of the contract. This work shall include repair of the various systems, removal of trapped sediment and cleaning of any silt filter fabric. Accumulated silt in sediment basins shall be removed at any time the basin becomes 75 percent filled. Any additional materials and work required by the Engineer will be measured and paid for as specified. If the Contractor fails to maintain the temporary erosion control systems as directed by the Engineer, the Engineer may apply the provisions of Article 280.03.

280.06 Method of Measurement. In the event that temporary erosion and pollution control measures are ordered by the Engineer due to the Contractor's negligence, carelessness, or failure to install permanent controls, the work shall be performed by the Contractor at his/her own expense. Temporary erosion and pollution control work ordered by the Engineer, which is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls, will be measured for payment according to the following:

(a) Excavation for Sediment Basins and Temporary Ditches. The volume of excavation for sediment basins and temporary ditches will be measured for payment in place and the volume computed in cubic meters (cubic yards).

(b) Temporary Ditch Checks. This work will be measured for payment as individual items and the unit of measurement will be each.

(c) Perimeter Erosion Barrier. This work will be measured for payment in meters (feet) in place.

(d) Inlet and Pipe Protection. This work will be measured for payment as individual items and the unit of measurement will be each.

(e) Temporary Erosion Control Seeding. This work will be measured for payment in kilograms (pounds) of seed applied. Open, broken, or partial

bags of seed will not be acceptable for use and will not be measured for payment.

(f) Temporary Mulch. This work will be measured for payment in hectares (acres).

(g) Aggregate. Aggregate used to control erosion will be measured for payment by weight in metric tons (tons). The aggregate shall be weighed on platform scales meeting the approval of the Engineer.

280.07 Basis of Payment. Temporary erosion control systems ordered by the Engineer, the need for which is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls, will be paid for according to the following:

(a) Excavation for Sediment Basins and Temporary Ditches. This work will be paid for at the contract unit price per cubic meter (cubic yard) for EARTH EXCAVATION FOR EROSION CONTROL.

(b) Temporary Ditch Checks. This work will be paid for at the contract unit price each for TEMPORARY DITCH CHECKS, regardless of the types of material or configurations used.

(c) Perimeter Erosion Barrier. This work will be paid for at the contract unit price per meter (foot) for PERIMETER EROSION BARRIER, regardless of the type used.

(d) Inlet and Pipe Protection. This work will be paid for at the contract unit price each for INLET AND PIPE PROTECTION, regardless of the type or configuration used.

(e) Temporary Erosion Control Seeding. This work will be paid for at the contract unit price per kilogram (pound) for TEMPORARY EROSION CONTROL SEEDINGS. When light disking of hard or caked soil is directed by the Engineer, it will be paid for according to Article 109.04.

(f) Temporary Mulch. Temporary Mulch will be paid for at the contract unit price per hectare (acre) for MULCH, METHOD 1, or MULCH, METHOD 2, according to Article 251.07.

(g) Aggregate. Aggregate used to control erosion will be paid for at the contract unit price per metric ton (ton) for AGGREGATE (EROSION CONTROL).

(h) Maintenance. Maintenance of temporary erosion control systems, including repair of the various systems, removal of entrapped sediment and cleaning of any silt filter fabric, will be paid for according to Article 109.04. The sediment shall be removed as directed by the Engineer during the contract period and disposed of according to Article 202.03.

The above pay items for temporary control systems shall include all materials and labor necessary to install, remove and dispose of the systems as shown on the plans or as directed by the Engineer. All temporary erosion control items shall be

removed at the direction of the Engineer and become the property of the Contractor at the completion of the contract; and be properly disposed of, off the job site.

If the Contractor is required to install any temporary erosion control system for which the contract does not include a bid item, such system(s) will be paid for according to Article 109.04.

SECTION 281. RIPRAP

281.01 Description. This item shall consist of furnishing and placing a protective course of stone, broken concrete or precast concrete blocks laid as riprap for erosion protection, sediment control or rock fill on slopes or in channels.

281.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Stone for Erosion Protection, Sediment Control and Rockfill	1005.01
(b) Concrete Block, Broken Concrete, Concrete Mats for Riprap	1005.02
(c) Filter Fabric	1080.03

CONSTRUCTION REQUIREMENTS

281.03 Foundation Preparation. The bed for the riprap shall be trimmed and shaped to allow the finished surface to conform to the lines specified. At the toe of the slope, the riprap shall commence on a continuation of the slope after excavation to accommodate the full depth of fabric, bedding layer, and riprap specified.

281.04 Placing. No riprap shall be placed until the foundation preparation has been approved by the Engineer. Installation of the filter fabric will be required under stone riprap gradations 4, 5, 6, and 7 for all uses, and under concrete block, broken concrete, and stone or broken concrete dumped riprap when used for erosion protection. The fabric shall be installed according to the plans and as specified in Section 282. A bedding layer will be required for stone riprap gradations 4, 5, 6, and 7, and for concrete block, broken concrete, and stone or broken concrete dumped riprap when used for erosion protection. No bedding layer will be required for concrete block riprap, broken concrete riprap or for stone or broken concrete dumped riprap when used for sediment control or rockfill.

(a) Stone Riprap. Gradation 1 shall be used as the bedding material for Gradations 4 and 5. Gradation 2 shall be used as the bedding material for Gradations 6 and 7. When filter fabric is used, coarse aggregate Gradation CA 1 may be used in lieu of Gradation 2, and coarse aggregate Gradation CA 3 may be used in lieu of Gradation 1. Bedding material shall be spread uniformly on the filter fabric in a satisfactory manner to the neat lines specified. Placing of material by methods which will tend to segregate particle sizes within the bedding will not be permitted. Any damage to the surface of the bedding base or the filter fabric during placing of the bedding shall be repaired before proceeding with the work. Compaction of the bedding layers will not be required but it shall be finished to present a

reasonably even surface free from mounds, windrows, or depressions. The thickness of the stone riprap layer shall be according to the following table:

Gradation	Min. Thickness	Bedding Thickness
1 & 2	150 mm (6 in.)	-
3	200 mm (8 in.)	-
4	400 mm (16 in.)	150 mm (6 in.)
5	550 mm (22 in.)	200 mm (8 in.)
6	650 mm (26 in.)	250 mm (10 in.)
7	750 mm (30 in.)	300 mm (12 in.)

Stone shall be placed on the bedding layer in such manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids providing maximum interlocking of stones and shall be constructed to the lines and grades shown.

The riprap shall not be placed or dropped from a height of more than 300 mm (1 ft). The stone riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the bedding material. Placing of material shall begin at the lower elevations, progressing up the slope and, from the center outward, unless otherwise determined by the Engineer. The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified. There shall be no abrupt changes in the riprap surface. All tapers between minimum thickness and any high points shall be at a uniform rate. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Placing riprap in layers will not be permitted. Placing riprap by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to obtain a reasonably well-graded distribution of stone sizes as specified above.

(b) Concrete Block Riprap. Bedding placement, when required, shall be as described for stone riprap in (a). Concrete blocks shall be laid with the joints perpendicular to the slope. The individual blocks in each horizontal course shall be placed when possible so that they will break joints with the blocks in the course below. For non-interlocking blocks, each tenth course shall be embedded into the slope with the long dimension of the blocks perpendicular to the slope.

(c) Broken Concrete Riprap. Bedding placement, when required, shall be as described for stone riprap in (a). The individual pieces of broken concrete shall be placed by hand, flat upon the slope. The pieces shall be laid with close joints, the larger pieces being placed in the lower courses. Any open joints shall be filled with spalls thoroughly rammed into place. The finished

surface of the riprap shall present an even, close surface, true to the lines, grades and sections given.

(d) Stone or Broken Concrete Dumped Riprap. Bedding placement, when required, shall be as described for stone riprap in (a). The dumped riprap shall be a minimum of 300 mm (12 in.) thick. Placement shall begin at the lower elevations and progress up the slope. Dumped riprap of stone or broken concrete, as specified, shall be placed on slopes or in channels by mechanical means. End dumping of material using mechanical equipment will be permitted provided the larger stone or pieces of broken concrete are well-distributed and the entire mass, in final position, is roughly graded to conform to the gradation specified. Placement by dumping into chutes or other methods likely to cause segregation will not be permitted.

The finished riprap shall be reasonably free from objectionable pockets of small pieces and clumps of large pieces, and the surface shall be shaped to follow the grade of the slope or channel. Rearranging of the dumped stone or broken concrete by mechanical equipment or by hand will be required only to the extent necessary to remove objectionable pockets or clumps of small or large material, and to obtain a surface reasonably true to line and grade.

(e) Concrete Mat Riprap. Laying of the concrete mats shall commence at the downstream end and proceed upstream. As mats are placed, the attached filter fabric shall be overlapped and the mats shall be clamped together and anchored. The upstream leading edge and the outside edges of the concrete matted area shall be trenched at least one block deep and backfilled. After placement, the voids between blocks in the mat shall be filled as shown on the plans.

281.05 Disposal of Surplus Material. Surplus or waste material resulting from the riprap operations shall be disposed of by the Contractor according to Article 202.03.

281.06 Method of Measurement. Riprap will be measured for payment in metric tons (tons) or measured in place, and the area computed in square meters (square yards). The area for measurement will include the upper sloped surface of the riprap and upper horizontal surface of the toe anchor

281.07 Basis of Payment. This work will be paid for at the contract unit price per square meter (square yard) or metric ton (ton) for STONE RIPRAP or STONE DUMPED RIPRAP of the class (stone quality and gradation) specified, CONCRETE BLOCK RIPRAP, BROKEN CONCRETE RIPRAP, BROKEN CONCRETE DUMPED RIPRAP, or CONCRETE MAT RIPRAP.

Filter fabric for use with riprap will be measured and paid for according to Section 282.

For concrete mat riprap, the filter fabric attached to the mat will be considered as included in the contract unit price bid for concrete mat riprap.

Excavation and aggregate bedding will not be paid for as separate items but shall be considered as included in the contract unit price bid for the Riprap.

SECTION 282. FILTER FABRIC FOR USE WITH RIPRAP

282.01 Description. This work shall consist of furnishing and installing geotechnical filter fabric in conjunction with riprap on prepared subgrades or embankment foundations.

282.02 Materials. Materials shall meet the requirements of the following Article of Section 1000 - Materials:

Item	Article/Section
(a) Filter Fabric	1080.03

CONSTRUCTION REQUIREMENTS

282.03 General. The weight of the filter fabric used will depend on the gradation of riprap specified. For riprap gradations 4 and 5, a fabric weight of 200 g/sq m (6 oz/sq yd) shall be used. A fabric weight of 270 g/sq m (8 oz/sq yd) shall be used with riprap gradations 6 and 7. The filter fabric shall be stored above the ground inside and away from sunlight at temperatures less than 60 ºC (140 ºF) and protected from any and all damage. The exposure of the filter fabric to the elements between laydown and cover shall be a maximum of 14 days.

282.04 Subgrade Preparation. The depth and area of excavation for the filter placement shall not exceed the dimensions necessary to properly place the filter fabric. Prior to the installation of the fabric, the foundation surface shall be cleared of debris, sharp objects and trees. Tree stumps shall be cut to the level of the prepared ground surface. If stumps cannot be cut to the ground level, they shall be completely removed. All wheel tracks, ruts, or surface irregularities in excess of 50 mm (2 in.) in depth shall be graded smooth or otherwise filled with soil to provide a reasonably smooth surface. The filter fabric shall not be placed until the prepared bed has been approved by the Engineer.

282.05 Placement. Filter fabric shall be placed in the manner and at the locations shown on the plans or as directed by the Engineer. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation or storage.

The fabric shall be unrolled directly over the area as shown on the plans. Fabric may be installed either by hand or mechanical methods provided the surface is not rutted. The fabric shall be laid loosely and free of tension, stress, folds, wrinkles, or creases. The fabric shall be turned down and buried 600 mm (2 ft) at all exterior limits, except where a stone filled key trench is provided below natural ground. As the riprap proceeds up the grade, the top edge of the fabric shall be buried as a part of the last operation. The fabric shall be placed with the long dimension parallel to the centerline of the channel or shoreline unless otherwise directed by the Engineer. Overlaps in the fabric should be placed so that any upstream strip of fabric will overlap the downstream strip, and the upslope roll should overlap the downslope roll.

Fabric of insufficient width or length to fully cover the specified area shall be lapped or sewn. The minimum laps for lap only areas are 300 mm (12 in.) and for sewn areas are 100 mm (4 in.).

If sewn, the fabric shall be stitched at a minimum rate of four stitches per 25 mm (1 in.) with high-strength polyester, polypropylene, or kevlar thread. The seam strength shall be equal to or more than the minimum grab tensile strength of the fabric when tested wet according to ASTM D 4632.

282.06 Securing Pins. Securing pins for anchoring filter fabric shall be nominally 5 mm (3/16 in.) diameter steel bars, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of not less than 40 mm (1 1/2 in.). The length of the pin shall not be less than 300 mm (12 in.). Securing pins shall be inserted through both strips of overlapped cloth at not greater than the following intervals along a line through the midpoint of the overlap.

Slope	Pin Spacing
Steeper than 1:3(V:H)	600 mm (2 ft)
1:3(V:H) to 1:4(V:H)	900 mm (3 ft)
Flatter than 1:4(V:H)	1.5 m (5 ft)

Each securing pin shall be pushed through the fabric until the washer bears against the fabric and secures it firmly to the foundation. Additional pins regardless of location shall be installed as necessary to prevent any slippage of the filter fabric. If the Engineer determines that the proper lap is not being maintained by the use of pins, then sewing will be required at no extra cost to the Department.

282.07 Protection. The fabric shall be protected at all times during construction from contamination by surface runoff and any fabric so contaminated shall be removed and replaced with uncontaminated fabric. Any damage to the fabric during its installation or during placement of riprap shall be replaced or repaired by the Contractor at his/her own expense. If the fabric is damaged during installation, the material around the rupture shall be removed and the damaged area covered with patch of fabric using an overlap of 1.2 m (4 ft) in each direction. The patch shall be held in position with securing pins.

282.08 Method of Measurement. Filter fabric will be measured for payment in place and the area computed in square meters (square yards). The buried edges of the fabric will not be measured for payment and the overlap joints and seams will be measured as a single layer of material.

282.09 Basis of Payment. This work will be paid for at the contract unit price per square meter (square yard) for FILTER FABRIC FOR USE WITH RIPRAP, which price shall include preparation of the subgrade beneath the fabric, and all materials and labor necessary for proper installation of the fabric.

SECTION 283. AGGREGATE DITCH

283.01 Description. This work shall consist of furnishing and installing aggregate in roadside ditches.

283.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Aggregate Ditch	1005.01
(b) Filter Fabric	1080.03

CONSTRUCTION REQUIREMENTS

283.03 Aggregate Ditch. The stone aggregate ditch shall be constructed on a filter fabric without any bedding material.

The filter fabric shall be constructed according to Section 282 except that the edges along the centerline of the ditch shall be turned down and buried 150 mm (6 in.), the upstream and downstream shall be turned down and buried 300 mm (12 in.), and securing pins at overlaps shall be inserted at each edge of the ditch bottom and at intervals of not greater than 1.5 m (5 ft) extending up the slopes.

The aggregate layer shall be a minimum of 300 mm (12 in.) thick and placed to the lines and grades as shown on the plans, or as directed by the Engineer. The placement of the aggregate shall begin at the lower elevation and proceed up the slope in such manner to construct a reasonably well graded mass of stone free from objectionable pockets of small stones and clusters of large stones. Arranging of stones may be required to the extent necessary either mechanically or by hand to obtain a well graded distribution of stone sizes and grade lines. Disturbed soil surfaces not covered with stone aggregate shall be seeded, fertilized and mulched according to Sections 250 and 251.

283.04 Method of Measurement. Aggregate ditch will be measured for payment in metric tons (tons) according to Article 311.08(b)..

283.05 Basis of Payment. This work will be paid for at the contract unit price per metric ton (ton) for AGGREGATE DITCH.

Filter fabric will be measured and paid for according to Section 282.

SECTION 284. GABIONS AND SLOPE MATTRESS

284.01 Description. This item shall consist of furnishing and placing a protective course of stone confined by wire baskets used as retaining walls, slope paving, bank protection, weirs, drop structures or outfall structures.

284.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Stone for Erosion Control (Note 1)	1005.01
(b) Gabions and Slope Mattress	1006.35
(c) Wire Fasteners	1006.36
(d) Anchor Stakes	1006.04, 1006.18
(e) Filter Fabric	1080.03

Note 1. The stone shall meet the requirements of Quality Designation A and shall not contain objectionable quantities of dirt, sand, clay or rock fines. The stone shall be well graded with maximum stone dimensions ranging between 100 mm and 200 mm (4 in. and 8 in.). No stone shall have minimum dimension less than 75 mm (3 in.) and the ratio of maximum to minimum dimension shall not be greater than two.

CONSTRUCTION REQUIREMENTS

284.03 Fabricating Gabions and Slope Mattresses. Baskets shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into rectangular baskets of the sizes specified and shown on the drawings. Baskets furnished by the manufacturer shall be of uniform size. Baskets shall be of single unit construction, i.e., the base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the basket in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh. Where the length of the basket exceeds 1 1/2 its horizontal width, the basket shall be equally divided by diaphragms, of the same mesh and gauge as the body of the baskets, into cells whose length does not exceed the horizontal width. The basket shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. Baskets shall be assembled by tying or fastening all untied edges. The tying wire shall be tightly laced around every fabric opening along the seams in such a manner that single and double loops are alternated. If wire fasteners are used, they shall be installed at approximately 100 mm (4 in.) to 150 mm (6 in.) intervals, but not less than one fastener for each fabric opening along the joint.

Sufficient wire fasteners, lacing, and connecting wire to match the basket material shall be supplied with the baskets for all fastening operations carried out in the construction of the gabion and mattress work.

All perimeter edges of the baskets, including end panels and the diaphragms, if any, shall be mechanically selvedged in such a way as to prevent any unravelling of the fabric and to develop the full strength of the fabric. The wire used for the selvedge shall have a diameter greater than that of the wire used to form the fabric.

284.04 Foundation Preparation. The bed for the gabions or slope mattress shall be trimmed and shaped to conform to the line and grade shown on the plans and as directed by the Engineer.

284.05 Placing. After the Engineer has approved the foundation preparation, a layer of filter fabric shall be installed. Installation of the filter fabric will be required under both the gabions and the slope mattress, and behind the gabions. The filter fabric shall be installed according to the plans.

The baskets shall be placed to conform with plan details. The stone material shall be placed in close contact in the unit so that maximum fill is obtained.

Empty basket units shall be assembled individually and placed on the approved surface to the lines and grades as shown on the drawings or as directed by the Engineer, with the sides, ends, and diaphragms erected in such a manner to insure the correct position of all creases and that the tops of all sides are level. All adjoining empty gabion units shall be secured to the adjoining unit in order to obtain a monolithic structure. Wire fasteners may be used in lieu of lacing wire for forming individual baskets, joining empty baskets together and closing lids. Binding wire or wire fasteners shall be used along vertical reinforced edges and top selvedges. When baskets are stacked, the base of the top basket shall be tightly wired or fastened to the lower basket at front and back. Lacing of adjoining basket units shall be accomplished by continuous stitching with alternating single and double loops at intervals of not more than 125 mm (5 in.). All lacing wire terminals shall be securely fastened. If wire fasteners are used, a fastener shall be provided at each fabric opening along the joint. A minimum of six fasteners are required per 1 m (3 ft) seam, three fasteners are required per 450 mm (18 in.) seam and two fasteners per 300 mm (1 ft) seam.

The initial line of basket units shall be placed on the prepared surface in a direction parallel to stream flow, and partially filled to provide anchorage against deformation and displacement during filling operations. After adjoining empty basket units are set to line and grade and common sides with adjacent units thoroughly laced or fastened, baskets shall be placed in tension and stretched to remove any kinks from the fabric and to a uniform alignment. The stretching of empty basket units shall be accomplished in such a manner as to prevent any possible unraveling.

Stone filling operations shall carefully proceed with placement by hand or machine so as not to damage the wire coating, to assure a minimum of voids between the stones, and the maintenance of alignment throughout the filling process. Undue deformation and bulging of the fabric shall be corrected prior to further stone filling. To avoid localized deformation, the basket units in any row are to be filled in stages consisting of maximum 300 mm (12 in.) courses. Baskets 450 mm (18 in.) tall or more shall use connecting wires in each internal compartment after each 225 mm (9 in.) or 300 mm (12 in.) layer except when the lid is closed over the last layer. For baskets 450 mm (18 in.) tall, the connecting wires shall be installed between the 225 m (9 in.) layers of stone. The 1 m (3 ft) tall baskets shall have connecting wires installed between each 300 mm (12 in.) layer of stone. These wires shall connect the front face to the back face. All connecting wires shall be looped around two fabric openings and the ends of the wires securely twisted to prevent loosening. For end units, two additional connecting wires shall be placed at each level perpendicular to the normally required connecting wires.

At no time shall any cell be filled to a depth exceeding 300 mm (12 in.) more than the adjoining cell. The maximum height from which the stone may be dropped into the basket units shall be 1 m (3 ft).

Along all exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to insure a neat and compact appearance. The last layer of stone shall be leveled with the top of the gabion to allow for the proper closing of the lid and to provide an even surface that is uniform in appearance. Lids shall be stretched tight over the stone fill using only an approved lid closing tool, until the lid meets the perimeter edges of the front and end panels. Using crowbars or other single point leverage bars for lid closing shall be prohibited. The lid shall then be tightly tied with lacing wire along all edges, ends, and internal cell diaphragms by continuous stitching with alternating single and double loops at intervals not more than 125 mm (5 in.). Wire fasteners may be used in lieu of lacing wire. Special attention shall be given to see that a projections or wire ends are turned into the baskets. Where shown on the drawings or as directed by the Engineer, or where a complete gabion unit cannot be installed because of space limitations, the basket unit shall be cut, folded, and wired together to suit existing site conditions. The fabric must be cleanly cut and the surplus fabric cut our completely, or folded back and neatly wired to an adjacent gabion face. The assembling, installation, filling, lid closing, and lacing of the reshaped gabion units shall be carried out as specified above.

The slope mattress shall be anchored as shown on the plans. If the Contractor elects to drill for the soil anchor stakes, care shall be taken to avoid drilling holes to a greater depth than is necessary to place the top of the finished stake slightly above the top of the finished mattress.

The Contractor may assemble, partially fill and tie together mattress units on the subgrade provided they can be placed on the slope without abrading the zinc or vinyl coating on the wire mattress or permanently distorting the shape of the mattress in transporting and installing the units on the slope. All prefabrication procedures shall be subject to the approval of the Engineer.

The Contractor shall maintain the gabions or slope mattress until final acceptance and any material displaced by any cause shall be replaced by the Contractor at his/her own expense.

284.06 Disposal of Surplus Material. Surplus or waste material resulting from the gabion or slope mattress operations shall be disposed of by the Contractor according to Article 202.03.

284.07 Method of Measurement. Gabions will be measured for payment in place and the volume computed to the nearest cubic meter (cubic yard), based on the actual lengths, widths and depths. Slope mattress will be measured for payment in place and the area computed in square meters (square yards) based on the actual lengths and widths over which placement is made.

284.08 Basis of Payment. This work will be paid for at the contract unit price per cubic meter (cubic yard) for GABIONS of the type material specified or at the contract unit price per square meter (square yard) for SLOPE MATTRESS of the type material and thickness specified.

Filter Fabric will be measured and paid for according to Section 282.

SECTION 285. CONCRETE REVETMENT MATS

285.01 Description. This work shall consist of constructing and placing fabric formed concrete revetment mats, precast block revetment mats, and articulated block mats as shown on the plans.

285.02 Materials. Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

	Item	Article/Section
(a)	Portland Cement (Note 1)	1001
(b)	Fine Aggregate (Note 2)	1003.02
(c)	Water	1002
(d)	Pozzolan	1010
(e)	Concrete Admixtures	1021.03
(f)	Filter Fabric	1080.03
(g)	Fabric	1080.04
(h)	Precast Block Revetment Mat	1081.11
(i)	Articulated Block Revetment Mat	1081.12

Note 1. Portland cement shall be Type I or Type II.

Note 2. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size which can be conveniently handled with available pumping equipment.

285.03 Equipment

(a) Fabric Formed Concrete Revetment Mat. Mixing and pumping equipment used in preparation and handling of the grout shall be approved by the Engineer. All oil or other rust inhibitors shall be removed from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used. The pumping equipment shall have a variable flow rate to provide enough pressure for pumping without breaking the fabric.

(b) Precast Block Revetment Mat and Articulated Block Revetment Mat. Equipment used to place preassembled mats shall be approved by the Engineer.

CONSTRUCTION REQUIREMENTS

285.04 Fabric Formed Concrete Revetment Mats. The slopes or surfaces to be protected shall be prepared and graded to such an extent that they are normally stable in the absence of erosive forces. Any fill material required to restore the slopes to original condition shall be approved by the Engineer.

The structural grout shall consist of a mixture of Portland Cement, fine aggregate and water so proportioned and mixed as to provide a pumpable slurry. Pozzolan and grout fluidizer may be used at the option of the Contractor. The structural grout shall have an air content of not less than 6.0 percent nor more than 9.0 percent of the volume of the grout. The mix shall obtain a compressive strength of 17,000 kPa

(2500 psi) at 28 days according to Article 1020.09. All materials shall be accurately measured by volume or mass (weight) as they are fed into the mixer. The quantity of water shall be such as to produce a grout having a pumpable consistency. Time of mixing shall be not less than one minute. If agitated continuously, the grout may be held in the mixer or agitator for a period not exceeding 2 1/2 hours in temperatures below 21 °C (70 °F), and for a period not exceeding two hours at higher temperatures. If there is a lapse in a pumping operation, the grout shall be recirculated through the pump or through the mixer drum (or agitator) and pump.

Prior to grout injection, the fabric shall be positioned at its design location. Each panel shall be a continuous or monolithic unit for its full width, including the trench portion.

Each panel shall consist of two or more mill-widths of open selvage construction; the two upper layers shall be joined together by sewing, and the two bottom layers shall be sewn together at the edges. Where adjacent panels cannot be joined in this manner, they shall be lapped a minimum of 600 mm (2 ft). In no case will simple butt-joints, either sewn or unsewn, be permitted. The ends and upper limits of the fabric shall be placed in a trench of suitable width as shown on the plans.

Small cuts shall be made in the fabric to allow for the insertion of the grout hose or grout nozzle. Grout shall be introduced into the space between the layers of fabric and shall be injected in such a way that excessive pressure on the fabric envelope is avoided. Starting at the lowest elevation and working up the slope, the grout shall be injected in such a way that the distance from the point of injection to the end of the panel is not greater than 9 m (30 ft). After grouting has been completed, the void between the trench wall and filled fabric shall be backfilled.

Holes in the fabric left by the removal of the grout hose or inserts shall be temporarily closed by inserting a piece of burlap or similar material. The burlap shall be removed when the mortar is no longer fluid and the surface is firm to hand pressure. Foot traffic on the filled revetment mats shall be limited to an absolute minimum for one hour after pumping in order to reduce indentation.

285.05 Precast Block Revetment Mats. The banks shall be graded as shown on the plans. A filter fabric shall be placed and fastened down prior to placing the precast blocks.

The blocks may be placed individually by hand or they may be preassembled in mats and placed using heavy equipment. Care shall be taken while placing the blocks on the fabric. After the precast blocks have been placed, the voids between the blocks shall be filled using the excavated earth or other acceptable material. The material used to fill the voids may or may not be seeded, as specified in the plans.

285.06 Articulated Block Mats. The banks shall be graded as shown on the plans. A filter fabric shall be placed and fastened down to placing the articulated block mat.

The preassembled mats will be placed individually by using heavy equipment. Care shall be taken while placing the mats on the filter fabric. After the mats have been placed, the voids between the blocks shall be filled using the excavated earth or other acceptable material. The material used to fill the voids may or may not be seeded, as specified in the plans.

285.07 Disposal of Surplus Material. Surplus or waste material resulting from the concrete revetment mat operations shall be disposed of according to Article 202.03. Excess excavated material shall not remain in the flood plain nor shall it be placed within the banks of the waterway.

285.08 Method of Measurement. Fabric Formed Concrete Revetment Mats will be measured in place and the area computed in square meters (square yards). The area for measurement will include the upper, sloped surface of the mat. The portion of the mat in trenches will not be measured for payment. No allowance will be made for overlaps.

Precast Block Revetment Mat and Articulated Block Mat will be measured in place and the area computed in square meters (square yards).

285.09 Basis of Payment. This work will be paid for at the contract unit price per square meter (square yard) for FABRIC FORMED CONCRETE REVETMENT MAT, PRECAST BLOCK REVETMENT MAT, or ARTICULATED BLOCK MAT.

When specified, seeding will be paid for according to Article 250.09.